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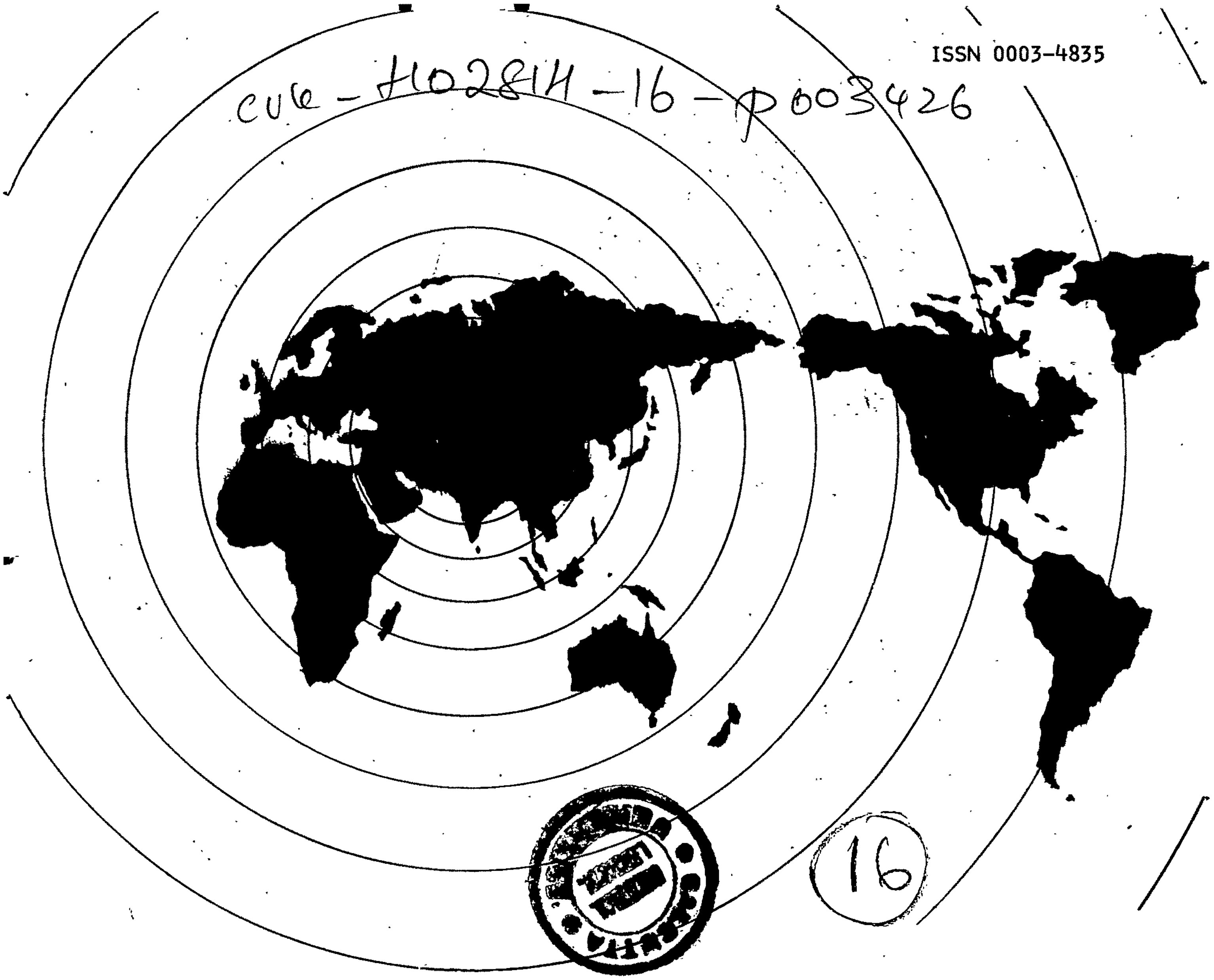

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INCREASING THE UTILISATION OF PERIODICALS IN COLLEGE LIBRARIES : A CASE STUDY

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Fast diffusion of information contained in periodicals among the faculty and research scholars can enhance the value and relevance of the instructional programmes and research/developmental work. To achieve this a "Quick Glance Service" has been introduced in the library of the Madras Institute of Technology, and it has proved to be an effective tool towards this objective.

1. INTRODUCTION

It is now generally accepted by research scientists, engineers and technologists that scientific and technical communications comprise the life blood of research and development. The progress of science and technology is impeded unless new knowledge generated by research flows freely, quickly and timely among the scientific and technical community. The increased rate of scientific discoveries accompanied by their rapid application through technology has added an element of greater urgency in disseminating research results among scientists and engineers. This point is amply driven home by the fact that the world generates new scientific and technical information at the rate of 4,000 articles per day. It is estimated that nearly 60,000 books, 2,00,000 research reports and 30,00,000 articles that appear in periodicals are published in a year [1]. Bernal had succinctly described the present situation by saying that while the amount to be read increases exponentially the time everyone has for reading remains the same [2]. The literature of scientific discoveries, growing at an exponential rate, are normally published as periodical articles since the periodicals are without doubt the best available among the primary communicating media for exchange of scientific research results among scientists and engineers. It is a fact that large number of these articles do not subsequently go into any other form of publications[3].

Almost every library spends a major share of its budget towards subscription to periodicals. Libraries do not mind spending enormous amount on subscription to periodicals but are reluctant to issue these periodicals on loan and restrict the issue even to their members. Storage and preservation of information for future use will no doubt be the best policy but periodical articles can be of much use only for a limited period[4]. The number of persons utilising these periodicals is also usually small. To increase the utility of periodicals and to realise the maximum benefit from the investment in periodicals various approaches have been made by the libraries according to their capacity.

2. LOW UTILISATION - A PAST EXPERIENCE

The library of the Madras Institute of Technology, Anna University, Madras, provides two borrowers cards, to its members irrespective of the category i.e. teaching staff, research scholar, students etc. for borrowing of periodicals for a period of seven days. Current periodicals (after display of 15 days) and back volumes are also made available to the members. The Library at present receives 323 scientific and technical periodicals as shown in Table 1.

However, utilisation of periodicals was very low and not in correspondence with the amount invested on subscriptions. This prompted the Library authorities to explore ways and means to increase the utilisation factor.

TABLE: 1 - Number of periodicals received in the Library.

	Foreign	Indian	Total
Subscription	180	46	226
Gift	69	28	97
TOTAL	249	74	323

3. METHODOLOGIES

Supplying contents page of current periodicals in photocopy or in typewritten form and preparing the Documentation or current awareness lists are widely followed in communicating the recent information presented in periodicals. These methods, which require technical manpower, financial assistance and the support of administrative authorities, have both patches of lights and shadows.

Some libraries send the periodicals, every month to the departments after their display in the library for a specified period, for study and return. The departments normally depute a member of the staff to receive these periodicals and then arrange to circulate them among members. It has been seen in many cases that the periodicals sent to departments are not circulated among the faculty members, but are kept locked in cupboards for months together to be returned to the library on receipt of reminders and in some cases losses also occur.

4. METHODOLOGY ADOPTED

41. *Quick Glance Service*

After examining the various pros and cons of the prevailing methods it was decided in October 1978 to circulate the new periodicals on receipt among all the teaching staff of this Institute, under the scheme of "Quick Glance Service". List of periodicals that are received in the library was circulated among the teaching staff with a request to indicate in the list, such titles that would interest them. On the basis of this a chart was prepared and the names of the staff members to whom the respective periodicals were to be sent on arrival were indicated against each title.

42. *Procedure*

After registering the new periodicals in the periodical register, the issues are entered in the circulation register against each individual who is covered by the QGS. The issues are sent to the concerned staff before 10.00 A.M. every day and they in turn arrange to return them to the library, the same day by 4.00 P.M. If an issue is required for perusal by more than one staff member of the same department 2 days time is allowed.

As soon as the periodicals come back the entries are cancelled against the staff member and they are displayed in the library for 15 days or till the receipt of the next issues whichever is earlier and the members can borrow these publications against their borrower's cards after their display.

43. *New Members to QGS*

When a new member joins the Institute, at the time of issuing him borrower's cards he is intimated about the facility of this service and he is asked to mark periodicals of his interest, in the current periodical list. The member's name is marked against the periodicals of his choice, in the chart maintained in the library, and arrangements are made for their circulation as mentioned.

5. SCOPE

The main outcome expected of the QGS services are as follows:

1. To maximize the utilisation of periodicals
2. To inform the teaching staff about the latest developments in their respective field.

6. UTILISATION

Statistics are maintained in the library to ascertain the effectiveness of this service. The number of periodicals issued during the past seven years has been analysed.

Normally, increase in utilisation of periodicals depends on the following factors:

(a) Increase in number of users

(b) Increase in number of periodicals that are received in the library.

(c) Kinds of periodicals subscribed.

The first two factors have been taken into consideration to determine the utilisation of periodicals. The ratio has been found out by using a simple mathematical formula:

$$U = I/M/P \quad \text{or} \quad \frac{I}{M \times P}$$

U = Utility Ratio
I = Number of periodicals issued
M = Number of eligible member
P = Number of periodicals received in the Library.

TABLE 2

Increase in the utilisation of periodicals

YEAR	No. of Members	No. of Periodicals received	No. of Periodicals Issued	Utility Ratio
	(M)	(P)	(I)	U = I/M/P
1975	431	198	3,081	0.0361
1976	434	198	3,229	0.0376
1977	435	203	3,239	0.0367
1978	441	224	4,015	0.0406
1979	449	256	4,839	0.0420
1980	507	260	5,909	0.0448
1981	516	271	7,072	0.0506
1982	524	323	7,668	0.0453**

** The institute was closed for about 2 months during this year and hence this drop.

Table 2 gives a vivid picture of the increase in utilisation of periodicals. The utility has nearly increased to one and half time within a limited period though the number of members of the library and number of periodicals have increased.

61. *Kind of Periodicals*

Let us consider the other factor that influence the increase in utilisation of periodicals. The nature of periodicals subscribed also plays, to a certain extent, a role in utilisation of resources. But this factor has not much influenced the utilisation since most of the periodicals were retained in the subscription list during these years for which study was carried out.

7. INFORMATION ON RECENT DEVELOPMENT

It is part of the duty of a librarian, to bring to the notice of the readers recent developments in the diverse fields, in particular, to the teaching and research staff of the institution for the following reasons:

The teaching staff may not find time to scan the periodicals in their fields due to heavy work load. They may not find time to visit the library. Hence the nascent information should be brought to their attention in order to equip themselves with the latest knowledge,

(a) to communicate the recent developments to student community.

(b) to stimulate the student members in the field of their study.

(c) to equip themselves adequately to answer the question raised by the student/s who acquire the knowledge of recent developments in the respective field.

(d) to pursue and guide research.

71. *Complexity of Abstracting Periodicals*

Abstracting periodicals, no doubt bring all the relevant articles pertaining even to microfield, under one shadow, but they do not attract all the readers except research scholars. A member of teaching staff who does not find time even to scan the primary periodicals naturally is not attracted by the secondary periodicals mainly due to their complexity.

72. *Scattering of periodical articles*

It has been estimated that only 1/3 of the relevant articles are published in the core periodicals of a subject. To be well informed of the latest information it is necessary to know about the contents of other periodicals also.

The Quick Glance Service enables them to be aware of articles of interest published in different periodicals. For this, the periodicals are scanned by the Librarian on receipt and articles of interest to particular staff member, if found, are marked for circulation to the concerned staff, though they may not have asked for the periodical under this scheme. The Director of this Institute, also peruses most of the periodicals, and marks the important articles to various departments/concerned staff for their study and applications or organizing projects, seminars, short courses etc.

8 LIMITATIONS OF THE STUDY

This study has the following limitations:

1. Periodicals that are referred to by users inside the library premises have not been included in the study.
2. Whether the periodicals borrowed by the members are really utilised by them or not is not known.
3. Certain periodicals are meant exclusively for certain specific type of users; and
4. All the periodicals of the same field are not equally attractive to all the readers in the same field.

9. ADVANTAGES

91 *Induces the Reading Habit*

Feeding the technical personnel with recent information for their teaching and research activities is a part of library services and it must be carefully planned and implemented since these technical personnel appear to be not properly utilising the library services either due to lack of time or being under the impression that they can manage with their old stock of information. R.W. Swanson has aptly pointed out that such individuals seem either be functioning without information or they are not recognizing libraries as a major source of information [5]. As a part of initiation, without irritation, the periodicals are placed on the tables of these technical persons. The periodicals that are placed on the table will certainly attract their attention one time or the other and induce them at least to browse through them.

92 *Coordination*

Any service ultimately rests on co-ordination among the participants and the serving community. Similarly, the success of this scheme depends very much on such co-ordination. In practice, this service creates a cordial relationship between the library personnel and the teaching community.

93 *Finance*

Any specialised service requires financial assistance. Shortage of finance at times cuts short useful services. This specialised service does not entail any huge expenditure. The main requirements of this service are:

(a) One hour service of an attendent to deliver the periodicals and

(b) the services of an assistant for half an hour to record the entries in the circulation register.

The total cost involved towards salary of these personnel for the duration indicated is negligible.

94 *Useful periodicals in subscription list*

Constant review of periodicals by a specialist in a given field helps to avoid inclusion of mediocre periodicals in the subscription list. The costlier periodicals are also reviewed against their utility for inclusion in subscription list.

95 *Impact on this service*

To ascertain the impact of the service, the Library Committee consisting of Professors and Heads of Departments, was entrusted with the task of periodically reviewing the actual working and suggest suitable modification if need be. The nine members Committee in consultation with the teaching staff of the department strongly pleaded for continuation of this service with the assurance of their coordination and help for continuing this service.

10 OTHER FEATURES

Besides the QGS service, important articles are announced on the notice boards either with attractive captions or the article itself is displayed. Often, review of an individual periodical consisting of the content, speciality etc., are also brought to the attention of members of the faculty through notice boards as well as through circulars to departments.

11 FUTURE PLANS

Timely availability of relevant and reliable information and data is important for making gainful decisions and triggering of new ideas[6]. Keeping this in view it is proposed to introduce documentation service with the co-operation and help of the teaching staff using the QGS service. On browsing through the periodicals the teaching staff have the opportunity to know the technological developments in the field of their interest and they may indicate such articles of interest, by marking in pencil, that could be indexed by the library and thus help maintain a reliable index file.

12. CONCLUSION

To date, the system has performed well under the existing conditions. Indications are that when its full potentials are realized, it will have a significant impact on the economic as well as the technological aspects.

To-day, though users' needs cannot be met fully by the libraries, it is believed that Quick Glance type of service will enable them to know their resources, and meet the users' need to a considerable extent.

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AGRIS – TOWARDS LEVEL TWO

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The essential role of information in the field of agriculture and the formation of AGRIS level I have been discussed. The thinking that have gone in the planning of AGRIS level II and its main characteristics are discussed.

1 INTRODUCTION

The essential role of information in the field of agriculture was recognized when the Food and Agriculture Organization (FAO) was formed and entrusted with the task of collecting, analysing, interpreting and disseminating information relating to its mandate. It was in accordance with this mission and its worldwide authority, that the representatives of the Commonwealth Agricultural Bureaux (CAB), the European communities and the U S National Agricultural Library (NAL) approached FAO in 1969 with a proposal for an international agricultural information network on the lines of International Nuclear Information System (INIS) under the broad framework of UNISIST Programme.

There were mainly two reasons due to which the efforts towards establishment of a network got momentum:

1. Frauendorfer's study [1] which reported the existance of about 700 abstracting journals in this field in 22 languages out of which about 64% were only in four European languages and none of them was comprehensive and worldwide in scope.

2. Social pressure: governments and international organizations were under constant pressure not to spend millions of dollars for building up an information system in the atomic energy field while ignoring to make an adequate investment for the information system in agriculture, where probabilities were high to increase world food production simply by applying existing knowledge.

A Panel of Experts set up by FAO after due deliberations proposed that it was indeed desirable to establish an "International Information System for the Agricultural Sciences and Technology" (AGRIS) [2]. In the conceptualization of the programme, two major activities were identified:

1. creation of a single worldwide data base in the agricultural sciences from which a current awareness service (in printed and tape form) could be offered; and

2. to coordinate specialized services in agricultural documentation so as to achieve a concentration rather than the present wasteful duplication in subject sub-disciplines. These two activities have since been known as 'AGRIS Level I' and 'AGRIS Level II'.

2 AGRIS LEVEL ONE

AGRIS Level I which became fully operational in January 1975 after 6 years of discussion, planning and evaluation, has been created through the cooperation of FAO of the United Nations, governments and institutions. It receives input currently from 94 countries and international organizations through national and regional input centres where relevant literature produced in their own country or region is identified, collected, catalogued in a standard format, categorized intro subjects, and titles translated into the carrier language - English (if necessary). These inputs, which are references to current literature of all types within the scope of the system are submitted to the AGRIS Coordinating Centre of the FAO, Rome where these are merged into a magnetic tape data base from which the following products are derived:

a. AGRINDEX - a monthly printed and categorized bibliography.

b. AGRIS Data Base on magnetic tape in which all references are available in machine readable form.

3 AGRIS DATA BASE AND AGRINDEX

Bibliographic title service offered by AGRIS data base is a fairly comprehensive service. Supplemented with five indexes (i.e. personal author, corporate author, report and patent number, commodities and geographical indexes) each issue of AGRINDEX contains about 11,000 references (January 1982 issue lists 13,278 items) scanned from 5,400 periodicals and other publications in 42 languages as against January-April, 1975 (4 months) issues which together indexed about 11,000 references. AGRIS data base has collected 7,07,875 references as of December 1981 which is about 15 times of 48,432 references collected upto December 1975 - the first operating year. About one-fifth of the total input comes from developing countries, though needs to be improved, presents a true partnership of developed and developing countries.

Despite its achievements AGRIS I is far from fully developed. An indexing system cannot meet the needs of real users in the field if it is not linked with abstracting service and efficient document delivery system. Studies by Lebowitz [3] and Longo et al.[4] reveal that its coverage is still half of what it ought to be. Almost half of the documents indexed are in English and more than 75% in just four European languages. Non-conventional literature accounts for little less than one-fifth of total input. Europe as a continent and United States as a country receive greatest coverage.

Nevertheless, there is much to believe that AGRIS I has contributed significantly to the development of national capabilities for the transfer and management of agricultural information in countries without fully developed system in this field.

4 AGRIS LEVEL TWO

The Panel of Experts in recommending to the Director General of FAO that AGRIS be established, suggested that the system be organized at two levels corresponding to different user's requirements. Level I was to provide rapid current awareness service without selectivity. Level II was conceived as a network of specialized services including specialized information centres, analysis centres and data banks with responsibility in depth for particular subject field so that the wasteful duplication in subject sub-disciplines could be avoided.

At its sixth meeting (Rome, 4-5 October, 1973), the Panel of Experts recommended the establishment of Level II operations in the fields of Veterinary science, Forestry, Tropical agriculture and in any other suitable and practicable area. Accordingly, a number of teams were constituted to conduct pilot studies for exploring the possibilities of Level II services in the respective areas. The efforts of these teams, except 'AGRIS Forestry' have not produced any fruitful results. Dutta[5] has reviewed progress made by these pilot study teams.

In the area of Forestry, as a result of AGRIS Forestry feasibility study[6] and subsequent expert consultations, work has started on:

i multilingual forestry thesaurus

ii world list of forestry periodicals

iii catalogue of forestry data bases and information services

iv cooperation amongst forestry information centres

Besides, Molster has proposed an organization structure for Level II service in the field of Forestry, based on the cooperation of subject-related information storage and retrieval centres irrespective of language and country[7].

AGRIS Level I and Level II were discussed at the same time and were conceived as complementary facets. While Level I has been, by and large, implemented effectively and efficiently since 1975, Level II is yet to get a start which can be attributed mainly to:

i lack of clarity over its structure and strategy to be followed;

ii subjects selected for pilot studies e.g. tropical agriculture, forestry etc. were too broad to manage; and

iii attitude of developed countries to such subjects was not encouraging, as Lancaster has reported, "tropical agriculture, a major concern of many of the developing countries is not our primary interest"[8].

5 WHAT IS LEVEL TWO

AGRIS Level II was envisaged as a complex of sophisticated information services to be constructed within the overall AGRIS framework. Where the Level I is concerned with bibliographical identification of documents and emphasizes comprehensiveness and speed of reporting, Level II handles the processing of document-content which involves:

a selection of the bibliographic material of enduring scientific merit on a specific subject;

b deep indexing and abstracting of each item to facilitate the retrieval and to determine its utility. This activity will ultimately result in the publication of abstracting journals; and

c provision of Selective Dissemination of Information (SDI) service and retrospective searching based on the computerized data base.

51 How of Level Two

Woolston, who has suggested alternative strategy for 'AGRIS Tropical' which is also applicable to AGRIS Level II in general, prefers to implement Level II in two phase[9]:

Level II A involves the publication of one or more abstract journals appropriately structured and indexed. The present services of the CAB, which are highly regarded by the scientific community exemplify his 'Level IIA' services.

Level II B makes the provision of services which are highly focussed in subject content and more diverse in products. In the field of agriculture these will often narrow the focus to a single crop eg. sorghum, millets, rice, etc. or a single aspect of agricultural practice eg. intercropping, irrigation etc. or it may go beyond the purely scientific aspect and deal with supply and demand of agricultural commodities.

These services are offered by specialized information analysis centres which are located where there is considerable research activity on the subjects. These information analysis centres will not only collect what is found in published literature (conventional) but also from unpublished literature (non-conventional) and invisible colleges by interaction with real workers in the field and as Molster[10] hopes, will be able to create integrated data bases containing about 80-90% of all known relevant records for their core area of interest. Such centres can truely be called as 'centres of excellence', where a good combination of research activity and information activity is found.

Woolston's idea of information analysis centres and Molster's concept of integrated data bases are based on the information services and data bases developed at the Cassava Information Centre of Centro Internacional de Agricultura Tropical (CIAT) at Cali, Colombia, the Tropical Legume Information Centre of International Institute of Tropical Agriculture (IITA) at Ibadan, Nigeria, the International Irrigation Information Centre at Bet Dagan, Israel, the Sorghum, and Millets Information Center of International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) at Patancheru, India, the Faba Bean Information Service of International Centre of Agricultural Research in Dry Areas (ICARDA), Syria, the Coconut Information Centre of Coconut Research Board at Lunuwila, Sri Lanka, the International Buffalo Information Centre at Kasetsart University, Bangkok, Thailand and the Aquatic Sciences and Fisheries Information System of the Fisheries Department of FAO. The services of all these centres have been appreciated and lauded by their users throughout the world.

The establishment of more such information centres on Wheat, Maize, Chickpea, Pigeonpea, Groundnut, Potato, Livestock, Farming Systems, or on any other crop or aspect of agriculture, will certainly be a step in right direction. Such centres can be attached to those national and international research organizations where a considerable work on the same subject is being carried out. As these research organizations are expected to have their own developed and well equipped library and documentation units, too much investment for developing infrastructures for these information centres is not required. With little more financial assistance these centres can start functioning.

International Development and Research Centre (IDRC), - Canada - which has already taken the lead and funding quite a good number of information centres; Consultative Group on International Agricultural Research (CGIAR) an international forum for supporting international agricultural research; and FAO can take up the responsibility to provide essential financial support. The activities of information centres, so created, will be coordinated by AGRIS Coordinating Centre. Each of these centres is expected to undertake:

i compilation of current and retrospective bibliographies;

ii development of its own integrated data base covering conventional and non-conventional literature;

iii provide SDI service linked with quick document delivery system;

iv technical query service;

v dissemination of information about new developments in the field by publishing newsletters; and

vi provide input for abstracting journals (proposed in Level II A), to issue reviews, and state-of-the-art reports.

6 CONCLUSION

It has been estimated that the coverage of any one agricultural data base (AGRICOLA, CAB, AGRIS) is less than two-thirds of all relevant information of all agricultural data bases together. It is, therefore, hoped that these information centres, which are smaller than Forestry, Tropical agriculture etc. will be able to develop their data base containing about 80% literature and will be in a better position to collect the remaining literature through personal contacts with scientists.

AGRIS, which has started as a cooperative venture of the nations and institutes has been able to cater to the information needs of agricultural scientists for more than 7 years now, though not fully, but it has certainly succeeded in stimulating the development of information handling infrastructures in many developing countries.

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MINI-COMPUTER AIDED KW&C INDEX

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The availability of minicomputers in our country can be utilized to generate computer aided indexes for many publications. This paper describes the experiments that were carried out for bringing out computer aided KW&C index having the combination of lower and upper case letters and produced with the help of minicomputer (HP-1000). A higher level language (FORTRAN IV) was utilized for developing the application package. As most of the minicomputers are having FORTRAN IV compiler, the portability of the package has been maintained.

1 INTRODUCTION

The use of computer for index generation has been justified for different reasons. After the preparation of indexes by the indexers the time consuming compilation and typing jobs can be very conveniently performed by mechanising the alphabetization and quick print out from the computer (composed material) for offset printing of the multiple copies. The alphabetized data can be stored for bringing out cumulative indexes. When we are going for computerising the index preparation we must remember certain important points:

i) Readability of the computer aided indexes should be comparable with the conventionally printed indexes. As far as possible we must try to bring out the computer print out of the indexes with the combination of upper and lower case letters.

ii) While bringing out the computer print out for the indexes, certain restrictions are imposed on the number of characters that can be accomodated in each line which necessiates the breaking of words. Random breaking of words results in awkward reading. So, care has to be taken to ensure that minimum word breaking takes place in the index.

iii) The indexes generated by the computer should not be brought out in single column print out as it results in unnecessary wastages of computer stationaries and involves some amount of manual labour for cutting, adjusting and pasting the computer print out on templet for production of multiple column offset printing. So, care should be given to explore the possibilities for bringing out the computer print out in the exact format with multiple column printing and with run-on heading and lower captions.

iv) As the generation of indexes by utilizing the computer is justified for many reasons, it can be predicted that in the near future people involved in the preparation of indexes will go more and more for computerization. Again, in this country there are now a growing abundance of minicomputer systems. So, the required software for the generation of indexes should be developed in such a way that it will be accepted by most of the computer systems.

In our country a number of attempts have already been made to generate computer aided indexes[1,2]. But most of the points discussed above have not been incorporated in their applications software.

2 AIM OF THE WORK

So, it is worthwhile to consider the four points discussed in the introduction and to incorporate them for designing a suitable system for the generation of computer aided indexes and accordingly develop an application software for this purpose. An attempt has been made to develop such a package in higher level language (FORTRAN IV, as most of the minicomputer systems possess FORTRAN IV compiler) taking into consideration of all the points discussed earlier for the generation of KW&C index.

3 ANALYSIS OF THE SYSTEM

A) If we analyse the data for Keywords and contexts we find that

i) Keywords and contexts are of variable length.

ii) Some keywords may have different contexts with different addresses.

iii) Some keywords may have same context with different addresses.

iv) Some keywords may not have context.

v) The same keywords without a context may have different addresses.

B) The minicomputer used by us is having a limited memory (generally 32k words, out of which 10-12k words are available to the user) whereas different tasks are to be performed for processing voluminous data.

C) Again, as in the inputting stage all letters are essentially in upper case and the intention is to bring out the indexes in upper and lower case letters, so care has to be taken in advance for the letters or words which do not require any conversion from upper to lower case.

4 DESIGN OF THE SYSTEM

```
0001  181234910ZIRCONIUM /INCORPORATION OF ANION IMPURITIES INTO THE ANODIC FILMS?
0002  181235010ANHARMONICITY /EFFECT ON@LAMB-@MOSSBAUER FACTOR FOR DISORDERED CRYSTAL?
0003  181235020LAMB-@MOSSBAUER FACTOR /EFFECT OF ANHARMONICITY?
0004  181235110LENNARD-@JONES FLUID /EQUILIBRIUM PROPERTIES?
0005  181235120PERTURBATION THEORY /OF@LENNARD-@JONES FLUID?
0006  181235210ETHYLENE DIAMINE.TETRA ACETIC ACID METAL CHELATE /ULTRASONIC STUDIES?
0007  181235220ULTRASONIC STUDY /OF ION-ASSOCIATION IN<EDTA>-METAL CHELATES?
0008  181235310SYAD@NYAYA SYSTEM /FORMULATION OF SENTENTIAL LOGIC AND ISOMORPHISM WIT?
0009  181235311H@BOOLEAN ALGEBRA?
0010  181235320<SNS> /FORMULATION OF SENTENTIAL LOGIC AND ISOMORPHISM WITH@BOOLEAN AL?
0011  181235321GEBRA?
0012  181235330SENTENTIAL LOGIC /SAYAD@NYAYA SYSTEM?
0013  181235340BOOLEAN ALGEBRA /SAYAD@NYAYA SYSTEM?
0014  181235410ELECTROMECHANICAL INTERACTION /IN BONES?
0015  181235420PIEZOELECTRIC EFFECT /ON@HAVERSION BONE?
0016  181235430HAVERSIAN BONE /PIEZOELECTRIC EFFECT?
```

Fig. 1 : Sample of data file.

The system has been designed to process all the five cases discussed in (A) (see Fig.1), and to tackle the problem as discussed in (B) and to perform the desired job, job steps have been increased appropriately. The difficulty mention in (C) has been resolved by using symbols namely @, < and >. For example, in Fig. 1, if we pick up the 2nd record we find that @ sign has been used before the characters L and M. It means that at the time of execution of a bit manipulation program, for converting upper to lower cases, the letters L and M will not be disturbed at all, whereas all other letters except the 1st character of keywords and 1st character of contexts will be converted to their lower case. This is achieved by making the symbol @ a blank character. If, instead of one character we want that a complete word (or more than one character) does not require any conversion, then it is put within < and > symbols (see 7th and 10th records in Fig. 1). Although by this design, our main problem is solved but as a side effect we encounter another problem. When < and > symbols appear in the 1st word of the keywords (see Rec. No. 10 in Fig. 1),

```
0001  ZIRCONIUM /INCORPORATION OF ANION IMPURITIES INTO THE ANODIC FILMS?                              12349
0002  ANHARMONICITY /EFFECT ON@LAMB-@MOSSBAUER FACTOR FOR DISORDERED CRYSTAL?                          12350
0003  LAMB-@MOSSBAUER FACTOR /EFFECT OF ANHARMONICITY?                                                 12350
0004  LENNARD-@JONES FLUID /EQUILIBRIUM PROPERTIES?                                                    12351
0005  PERTURBATION THEORY /OF@LENNARD-@JONES FLUID?                                                    12351
0006  ETHYLENE DIAMINE TETRA ACETIC ACID METAL CHELATE /ULTRASONIC STUDIES?                            12352
0007  ULTRASONIC STUDY /OF ION-ASSOCIATION IN<EDTA>-METAL CHELATES?                                    12352
0008  SYAD@NYAYA SYSTEM /FORMULATION OF SENTENTIAL LOGIC AND ISOMORPHISM WITH@BOOLEAN ALGEBRA?        12353
0009  <SNS> /FORMULATION OF SENTENTIAL LOGIC AND ISOMORPHISM WITH@BOOLEAN ALGEBRA?                     12353
0010  SENTENTIAL LOGIC /SAYAD@NYAYA SYSTEM?                                                            12353
0011  BOOLEAN ALGEBRA /SAYAD@NYAYA SYSTEM?                                                             12353
0012  ELECTROMECHANICAL INTERACTION /IN BONES?                                                         12354
0013  PIEZOELECTRIC EFFECT /ON@HAVERSION BONE?                                                         12354
0014  HAVERSIAN BONE /PIEZOELECTRIC EFFECT?                                                            12354
```

Fig. 2 : Sample of fixed length records generated from data file.

```
 1   ZIRCONIUM /INCORPORATION OF ANION IMPURITIES INTO THE ANODIC FILMS?
                                             12349ZIRCONIUM /INCORPORATION
 2   ANHARMONICITY /EFFECT ON@LAMB-@MOSSBAUER FACTOR FOR DISORDERED CRYSTAL?
                                             12350ANHARMONICITY /EFFECT ON@
 3   LAMB-@MOSSBAUER FACTOR /EFFECT OF ANHARMONICITY?
                                             12350LAMB-@MOSSBAUER FACTOR /E
 4   LENNARD-@JONES FLUID /EQUILIBRIUM PROPERTIES?
                                             12351LENNARD-@JONES FLUID /EQU
 5   PERTURBATION THEORY /OF@LENNARD-@JONES FLUID?
                                             12351PERTURBATION THEORY /OF@L
 6   ETHYLENE DIAMINE TETRA ACETIC ACID METAL CHELATE /ULTRASONIC STUDIES?
                                             12352ETHYLENE DIAMINE TETRA AC
 7   ULTRASONIC STUDY /OF ION-ASSOCIATION IN<EDTA>-METAL CHELATES?
                                             12352ULTRASONIC STUDY /OF ION-
 8   SYAD@NYAYA SYSTEM /FORMULATION OF SENTENTIAL LOGIC AND ISOMORPHISM WITH@BOOLEAN
     ALGEBRA?                                12353SYAD@NYAYA SYSTEM /FORMUL
 9   <SNS> /FORMULATION OF SENTENTIAL LOGIC AND ISOMORPHISM WITH@BOOLEAN ALGEBRA?
                                             12353SNS  /FORMULATION OF SEN
10   SENTENTIAL LOGIC /SAYAD@NYAYA SYSTEM?
                                             12353SENTENTIAL LOGIC /SAYAD@N
11   BOOLEAN ALGEBRA /SAYAD@NYAYA SYSTEM?
                                             12353BOOLEAN ALGEBRA /SAYAD@NY
12   ELECTROMECHANICAL INTERACTION /IN BONES?
                                             12354ELECTROMECHANICAL INTERAC
13.  PIEZOELECTRIC EFFECT /ON@HAVERSION BONE?
                                             12354PIEZOELECTRIC EFFECT /ON@
14   HAVERSIAN BONE /PIEZOELECTRIC EFFECT?
                                             12354HAVERSIAN BONE /PIEZOELEC
```

Fig. 3 : Sample of records created from the fixed length records (125) by picking first 25 characters and adding those characters at the end of fixed length records.

such records, at the time of alphabatization, instead of taking their normal alphabetical positions, appear before the letter 'A' as this symbol has got priority over letter 'A'. To solve this problem one more job step has to be added. From the master file, of fixed record length created from the data file, the first 25 characters are picked up and if the symbol (< and >) appear in these 25 characters they are being removed and squeezed appropriately. These squeezed 25 characters or unaltered 25 characters are being added at the end of the original master file records. So the record length is being enhanced by 25 characters more (see Fig. 3). At the time of alphabatization these 25 characters are treated as primary key.

The flow of the job is given in Fig. 6.

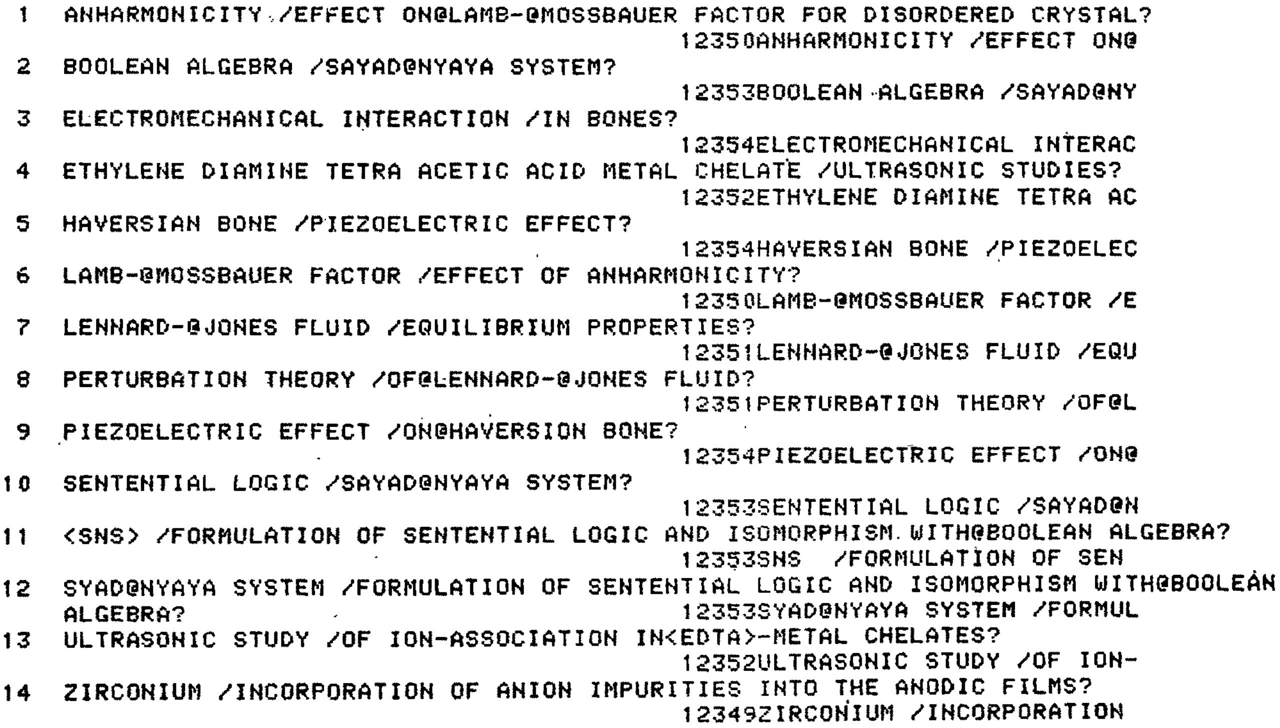
5. DISCUSSIONS OF DIFFERENT JOB STEPS

1st Step: As the input data preparation is being made from the key to tape machine EC9002, the code for representation of the characters is in EBCDIC. But as the system (HP-1000) accepts ASCII-7 bit code for processing the characters, so conversion from EBCDIC to ASCII is needed. If we use any data entry system having ASCII-7 bit representations for the characters then this step can be eliminated.

2nd step: In this step one program is executed to create a file of fixed length records (see Fig.2) from the variable length keywords and contexts file. The length of the records has been fixed at 125 as it has been observed that the maximum length of the keywords and contexts does not exceed 120, the remaining 5 characters are preserved for the address. If the number of records exceeds 2000, then this program breaks the file into two, three or four files depending on the numbers of records in the file. This is due to the constraint on space limitation in the diskette while using the sort and merge program.

3rd step: As discussed in section (4), in this step the records of record length 150 characters are being generated. Special symbols < and >, if any, are removed from the last 25 characters (see Fig.3).

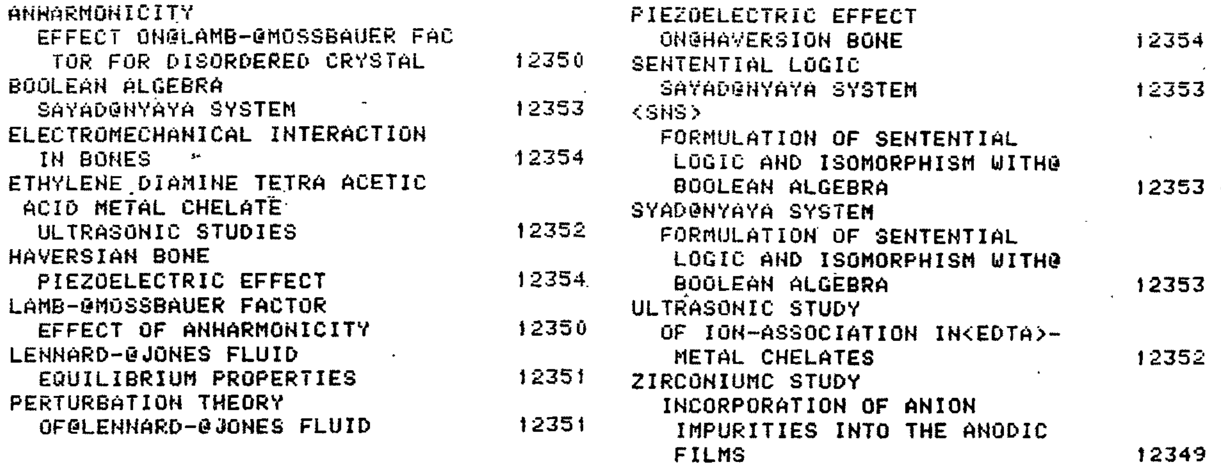
4th step: The file (files) thus created in step 3 is (are) alphabatized (see Fig. 4) by using sort and merge program. The keys are: 126, 25, Ascending (primary) & 26, 100, ascending (secondary).



```
 1  ANHARMONICITY /EFFECT ON@LAMB-@MOSSBAUER FACTOR FOR DISORDERED CRYSTAL?
                                             12350ANHARMONICITY /EFFECT ON@
 2  BOOLEAN ALGEBRA /SAYAD@NYAYA SYSTEM?
                                             12353BOOLEAN ALGEBRA /SAYAD@NY
 3  ELECTROMECHANICAL INTERACTION /IN BONES?
                                             12354ELECTROMECHANICAL INTERAC
 4  ETHYLENE DIAMINE TETRA ACETIC ACID METAL CHELATE /ULTRASONIC STUDIES?
                                             12352ETHYLENE DIAMINE TETRA AC
 5  HAVERSIAN BONE /PIEZOELECTRIC EFFECT?
                                             12354HAVERSIAN BONE /PIEZOELEC
 6  LAMB-@MOSSBAUER FACTOR /EFFECT OF ANHARMONICITY?
                                             12350LAMB-@MOSSBAUER FACTOR /E
 7  LENNARD-@JONES FLUID /EQUILIBRIUM PROPERTIES?
                                             12351LENNARD-@JONES FLUID /EQU
 8  PERTURBATION THEORY /OF@LENNARD-@JONES FLUID?
                                             12351PERTURBATION THEORY /OF@L
 9  PIEZOELECTRIC EFFECT /ON@HAVERSION BONE?
                                             12354PIEZOELECTRIC EFFECT /ON@
10  SENTENTIAL LOGIC /SAYAD@NYAYA SYSTEM?
                                             12353SENTENTIAL LOGIC /SAYAD@N
11  <SNS> /FORMULATION OF SENTENTIAL LOGIC AND ISOMORPHISM WITH@BOOLEAN ALGEBRA?
                                             12353SNS  /FORMULATION OF SEN
12  SYAD@NYAYA SYSTEM /FORMULATION OF SENTENTIAL LOGIC AND ISOMORPHISM WITH@BOOLEAN
    ALGEBRA?                                 12353SYAD@NYAYA SYSTEM /FORMUL
13  ULTRASONIC STUDY /OF ION-ASSOCIATION IN<EDTA>-METAL CHELATES?
                                             12352ULTRASONIC STUDY /OF ION-
14  ZIRCONIUM /INCORPORATION OF ANION IMPURITIES INTO THE ANODIC FILMS?
                                             12349ZIRCONIUM /INCORPORATION
```

Fig. 4 : Sort and merge file.

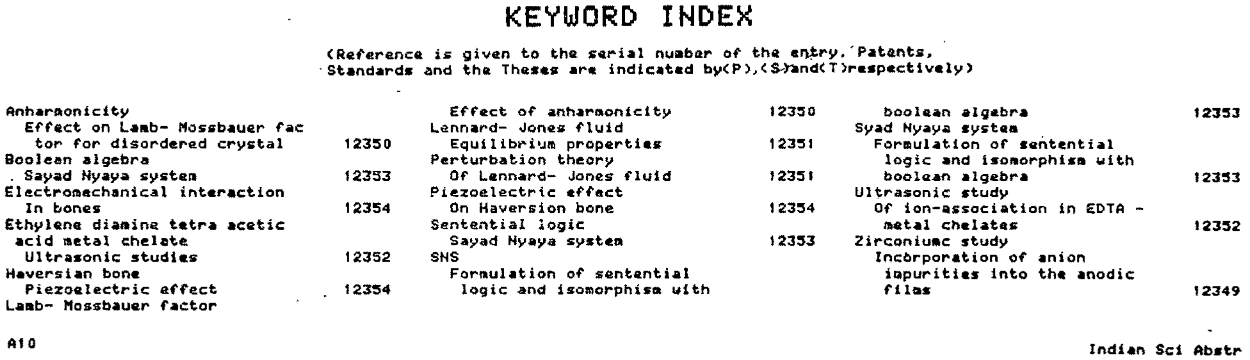
5th step: The program cnly takes 125 characters out of 150 character records from sorted and merged file. The software takes care of all the points discussed in section (3A), breaks the records into a number of fixed (32) character length records for bringing out the index column-wise and prevent word breaking (see Fig. 5A). The program also displays the total number of 32 character records created from the merged file which helps to bring out the final printout in page format, lower caption and run-on heading. The conversion from upper to lower cases as and when required is being done at this final stage (see Fig. 5B).



```
ANHARMONICITY
  EFFECT ON@LAMB-@MOSSBAUER FAC
   TOR FOR DISORDERED CRYSTAL        12350
BOOLEAN ALGEBRA
  SAYAD@NYAYA SYSTEM                 12353
ELECTROMECHANICAL INTERACTION
  IN BONES                           12354
ETHYLENE DIAMINE TETRA ACETIC
 ACID METAL CHELATE
  ULTRASONIC STUDIES                 12352
HAVERSIAN BONE
  PIEZOELECTRIC EFFECT               12354
LAMB-@MOSSBAUER FACTOR
  EFFECT OF ANHARMONICITY            12350
LENNARD-@JONES FLUID
  EQUILIBRIUM PROPERTIES             12351
PERTURBATION THEORY
  OF@LENNARD-@JONES FLUID            12351

PIEZOELECTRIC EFFECT
  ON@HAVERSION BONE                  12354
SENTENTIAL LOGIC
  SAYAD@NYAYA SYSTEM                 12353
<SNS>
  FORMULATION OF SENTENTIAL
   LOGIC AND ISOMORPHISM WITH@
   BOOLEAN ALGEBRA                   12353
SYAD@NYAYA SYSTEM
  FORMULATION OF SENTENTIAL
   LOGIC AND ISOMORPHISM WITH@
   BOOLEAN ALGEBRA                   12353
ULTRASONIC STUDY
  OF ION-ASSOCIATION IN<EDTA>-
   METAL CHELATES                    12352
ZIRCONIUMC STUDY
  INCORPORATION OF ANION
   IMPURITIES INTO THE ANODIC
   FILMS                             12349
```

Fig.5A: Column wise break up of the index.



```
                 KEYWORD INDEX

(Reference is given to the serial number of the entry. Patents,
Standards and the Theses are indicated by(P),(S)and(T)respectively)

Anharmonicity
  Effect on Lamb- Mossbauer fac
   tor for disordered crystal        12350
Boolean algebra
 . Sayad Nyaya system                12353
Electromechanical interaction
  In bones                           12354
Ethylene diamine tetra acetic
 acid metal chelate
  Ultrasonic studies                 12352
Haversian bone
  Piezoelectric effect               12354
Lamb- Mossbauer factor

  Effect of anharmonicity            12350
Lennard- Jones fluid
  Equilibrium properties             12351
Perturbation theory
  Of Lennard- Jones fluid            12351
Piezoelectric effect
  On Haversion bone                  12354
Sentential logic
  Sayad Nyaya system                 12353
SNS
  Formulation of sentential
   logic and isomorphism with

   boolean algebra                   12353
Syad Nyaya system
  Formulation of sentential
   logic and isomorphism with
   boolean algebra                   12353
Ultrasonic study
  Of ion-association in EDTA -
   metal chelates                    12352
Zirconiumc study
  Incorporation of anion
   impurities into the anodic
   films                             12349

A10                                              Indian Sci Abstr
```

Fig.5B: Sample of KW&C print out with page format in lower and upper case letters.

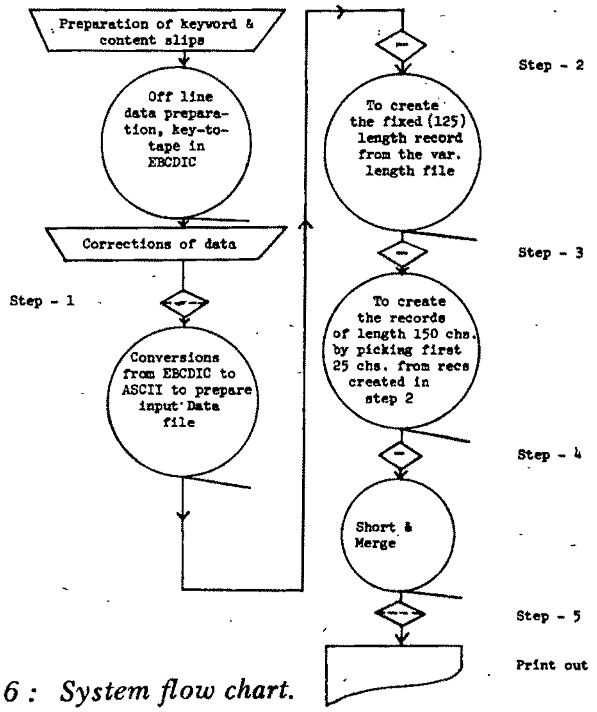

Preparation of keyword & content slips
Off line data preparation, key-to-tape in EBCDIC
Corrections of data
Step - 1
Conversions from EBCDIC to ASCII to prepare input Data file
Step - 2
To create the fixed (125) length record from the var. length file
Step - 3
To create the records of length 150 chs. by picking first 25 chs. from recs created in step 2
Step - 4
Short & Merge
Step - 5
Print out

Fig. 6 : System flow chart.

6 SYSTEM REQUIREMENT

Minicomputers having 32 keywords memory, FORTRAN IV compiler, two tape drives, one diskette/disk drive, a line/matrix printer and provisions for the representation of the upper and lower case letters are necessary and sufficient for implementing the package.

7 CONCLUDING REMARKS

The experiment was successfully carried out with the in-house computer system HP-1000 at Insdoc. The package is now in operation from the month of July 1982 issue of the Indian Science Abstracts (ISA).

ACKNOWLEDGEMENT

I am very much thankful to the Scientist-in-Charge, INSDOC for providing me the facilities for carrying out this work. I am also thankful to Prof. B. Guha for his encouragement while experimenting with this work. My special thanks go to the Computer Operator Shri Daljit Singh Sahani of NIC for his tireless co-operation at the time of testing and debugging the programs. Thanks are also due to Shri S.K. Sen for his valuable discussions.

REFERENCES

[1] Raizada A.S., Haravu L.J. and Arora A.M: Keyword Index to Indian Science Abstracts, Ann Lib Sci Doc, 1967, 14(1), LO-33.

[2] Murty D.S.R.: Publication of KWOC index of a research journal using IBM 1620. Ann Lib Sci Doc, 1972, 19, 205-21.

Annals of Library Science and Documentation
1983, 30(1), 17-21

PATENT INFORMATION RETRIEVAL : NEED FOR SUBJECT INDEXES

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Discusses the contents of patents and their utility as source of scientific and technological information. Information services in the field of patents with special reference to the services brought out by Derwent Publications Ltd., London have been described. The need for subject indexes and their usefulness for patent information services like other secondary services has been emphasised.

INTRODUCTION

Scientific and technological information is the life blood of the innovative and inventive process. Along with a number of sources of scientific and technological information, such as, periodicals, reports, conference proceedings --patent specifications are also important sources of scientific and technological information. A patent is basically a bargain and an exclusive legal right between the patentee and the government granting the patent. Every patent contains a patent number, which helps in the identification of the document; date of issue on which the patent is granted; application date on which the patentee applies for a patent to the patent office; serial number given by the patent office on receipt of the application; title of the patent; name of the patentee; classification number i.e. a specific class assigned to a patent by the patent office; details of the specification and the claims made by the patentee.

PATENTS AS SOURCE OF SCIENTIFIC AND TECHNOLOGICAL INFORMATION

Patents contain a wealth of information on developments in all areas of technology, on very many occasions being the first and only published source in any kind of literature. For example, Hollerith's patent on punched cards and machines for processing punched cards was taken in 1889 but no information on them was available in other forms of literature till 1941. The information contained in patents is in much more complete form than other sources of information and these are concerned with specific application of technology. For example, the British Patent Number 749836 on a computing device has 267 printed pages plus 780 drawings. A patent describes not only a novel extention of what was previously known, but may also contain ideas which were not obvious to a person of ordinary skill in the art. Due to all these reasons patent literature is a more fertile source of useful and innovative information. Even then the patent literature is not used to the extent it should be. The various reasons for their meagre use have been mentioned by Liebesney et al [1] as follows:

(1) Patents are written primarily as legal documents in legal language and this has been a deterrent to their use by engineers and scientists who are not accoustomed in dealing with legalese.

(2) Ignorance on the part of many scientists, technologists and even some science information workers as to the type of information contained in patent specifications.

(3) Lack of education on the patent system as a whole and how the literature may be acquired. Relative to scientific and technical journals, patents are generally inaccessible.

(4) Owing to the lengthy process of examination of a patent application, there may be a time lag of at least 2-3 years between the filing of the information in the form of a patent

application and its publication as a specification. Therefore, such published information may be considered obsolete.

(5) Secondary patent literature as abridgements, abstracts etc. may not be as efficient and useful as it could be. Also patents are not as well covered by secondary literature sources, such as abstracting and indexing services, except of the chemical area.

(6) It may be considered by providers and users of information that relevant information contained in patents will come to their notice by other means e.g. from periodical literature.

PATENT INFORMATION SOURCES

Existing patent information sources and services can be divided into three catagories. These are the national sources and services brought out by the patent office of a country, such as, Official Gazette of the U.S. Patent and Trademark Office published by the Superindent of Documents, U.S.A. The second category includes international services of the World Intellectual Property Organisation (WIPO) and International Patent Documentation Centre (INPADOC). The services brought out by INPADOC include Patent Family Service (PFS); Patent Classification Service (PCS); Patent Application Service (PAS); Numerical Data Base Service (NDBS) and the Patent Gazette. The third catagory includes commercial services. The most important commercial service is from the Derwent Publications Ltd., London.

The services brought out by the Derwent Publications Ltd, London, are World Patent Index (WPI), Central Patent Index (CPI), Electrical Patent Index (EPI), and World Patents Abstracts. All these publications are published weekly. The WPI is published in four editions which include Chemical, Electrical, Mechanical and General Sections. The CPI is a comprehensive abstracting and retrieval service in the field of chemical patents and started publishing in 1970. The patents covered in CPI are further sub-divided into twelve catagories (Appendix A). The EPI, which commenced its publication in June 1980, is a significant service in the field of Electrical patents. The patents covered in EPI are further sub-divided into six sections (Appendix A). The EPI is also available in six different sections with overlap between sections where-ever appropriate. World Patents Abstracts service includes German Patents Gazette,German Patents Abstracts, Soviet Inventions Illustrated, United States Patents Abstracts, Belgian Patents Abstracts, British Patents Abstracts, European Patents Reports, and PCT Patent Report which are published in Chemical, Electrical, Mechanical and General sections. While the French Patents Abstracts, Japanese Patents Reports, Japanese Patents Gazette and Netherland Patents Reports cover the chemical patents only. For the publication of these services Derwent acquires patents from various countries of the world which constitute 90% of the total patents produced in the world.

Apart from these services, there are publications which include patents as one of the many forms of scientific literature. These are the chemical Abstracts, Computer Abstracts, World Surface Coating Abstracts, Cybernetics Abstracts and Electronics and Communications Abstracts Journal, etc.

NEED FOR SUBJECT INDEXES AND THEIR USEFULNESS

Patent information sources are accessed both for current as well as for retrospective search. Current awareness service can be best provided by scanning the patent information sources and bringing out a local current awareness bulletin in the field of interests of the users. Retrospective search is necessary when one is thinking to undertake a new project or is considering to file a patent application.

The abstracts in the official gazettes as well as in the services published by Derwent Publications are arranged according to World Patent Index Classification scheme which, at best, can provide only a generic subject approach. The indexes provided in these services are usually the Patent Number Index, Patentee Index and the Accession Number Index. These indexes are neither adequate for current information retrieval nor for retrospective search. The following examples will illustrate the fact.

S.No.	Title of the Patent and Source	Patent No.	Patentee
1.	Infrared multilayer Film Thickness Measuring Method and Apparatus. U.S. Pat. Off. Gaz. Vol.1002 No.1, January 1981, p.358.	4,243,882	Ashai-Dow Ltd.
2.	Fire and Absence Detection and Alarm System for Bed Occupants. U.S. Pat. Off. Gaz. Vol.1005,No.4, April 1981, p.1707.	4,264,904	McCoy,Roy G & Mathis,James C.
3.	Electric Circuit Breaker. U.S. Pat. Off. Gaz. Vol.1004,No.4. May 1981, p.1678.	4,258,239	Siemens Aktiengeselschaft
4.	Analog to Digital Converter for Electronic Engine Control System. U.S. Pat. Off. Gaz. Vol.1005,No.4, April 1981, p.1705.	4,264,898	Bendix Corporation
5.	Apparatus for Encoding and Decoding Data Signals. U.S. Pat. Off. Gaz. Vol.1005,No.4, April 1981, p.1666.	4,264,781	NCR Corporation
6.	Production of Industrial Electrical Energy from Hydraulic Energy, U.S. Pat. Off. Gaz. Vol.1000, No.2, Nov. 1980, p.474.	4,232,524	Raymond Goyat

The user cannot lay his hands directly on the patents mentioned above unless he is aware either of the patent number or the name of the patentee. Thus, the indexes provided in the official gazettes as well as in the services published by Derwent Publications are not adequate for directing a user to the patent abstract of his interest.

The above patents have also been covered by Electronics and Communications Abstracts Journal, Vol.15, No.1, 1982 published by the Cambridge Scientific Abstracts, England. A user can access these patents easily in this service because at the end a subject index with various search terms, as described in the next page,have been given.

In the examples cited above, the user need not know the patent number or the name of the patentee because he is well aware with the field in which he wants to collect/search information.

The provision of subject indexes will help a user to locate relevant abstracts of his interest and he will be able to use the subject indexes for his particular search needs. The user will be able to obtain the information he seeks with minimum of efforts and thus, it will minimise the search time. Such indexes could be cumulated periodically, that is, half-yearly or annually. The cumulation will help in retrospective search.

CONCLUSION

It is true, computer search techniques can be helpful in the retrieval of information from the patents data bases. However, it may be pointed out that although most of the prestigious abstracting and indexing services of the world such as the Chemical Abstracts, Science Abstracts have now machine readable data bases still they continue to provide printed subject

S.No.	Abstract No.	Title of the Patent	Search Terms
1.	00249	Infra-red Multilayer Film Thickness Measuring Method and Apparatus.	Film Thickness.Measurement & Measurement. Film Thickness
2.	00678	Fire and Absence Detection and Alarm System for Bed Occupants	Alarm System. Fire Protection or Fire Protection.Alarm System
3.	00087	Electronic Circuit Breaker	Circuit Breaker.Electrical Arc. or Electrical Arc.Circuit Breaker
4.	00818	Analog to Digital Converter for Electronic Engine Control System.	Analog to Digital Converter. Electronic Engine Control or Electronic Engine Control. Analog to Digital Converter.
5.	01582	Appartus for Encoding and Decoding Data Signals.	Data. Decoder. Encoder or Decoder. Data or Encoder. Data
6.	00147	Production of Industrial Electrical Energy from Hydraulic Energy	Energy Conversion or Energy. Electrical.Production or Electrical Energy Production or Production.Electrical Energy

indexes. One of the reasons for this is that in most of the developing countries, computer facilities are not available and in near future too, they are not likely to be available. In view of this, it is necessary that patent information sources should be provided with subject indexes like other abstracting and indexing services. The provision of such indexes will make the patent information sources more easily accessible and a more useful source of scientific and technological information.

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Based on paper presented at the National Seminar on Patents held at RRL, Hyderabad, 28-29 November 1981.

Appendix 'A'

CENTRAL PATENT INDEX CLASSIFICATION

A : PLASDOC
B : FARMDOC
C : AGDOC
D : FOOD DETERGENTS
E : CHEMDOC
F : TEXTILES, PAPER, CELLULOSE
G : PRINTING, COATING,PHOTOGRAPHIC
H : PETROLEUM
J : CHEMICAL ENGINEERING
K : NUCLEONICS,EXPLOSIVES,PROTECTION
L : REFRACTORIES,CERAMICS,CEMENT
M : METALLURGY

ELECTRICAL PATENT INDEX CLASSIFICATION

S : INSTRUMENTATION,MEASURING AND TESTING
T : COMPUTING AND CONTROL
U : SEMICONDUCTORS AND ELECTRONIC CIRCUITRY
V : ELECTRONIC COMPONENTS
W : COMMUNICATIONS
X : ELECTRONIC POWER ENGINEERING

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BIBLIOGRAPHICAL PHENOMENA OF PHYTOMORPHOLOGY LITERATURE : A CITATION ANALYSIS

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The study analyses the citations contained in volumes 25-29; 1975-79 of Phytomorphology. Attempts to identify the principal bibliographical forms; frequently cited journals, their productivity, geographical distribution, obsolescence and scattering of research literature used by Phytomorphologists. Points out that these data are useful for librarians in the selection and acquisition of documents in academic and research libraries to meet the present day needs of scientists.

1 INTRODUCTION

This study attempts to identify the citation patterns, obsolescence, and scattering of the research literature used by Phytomorphologists during the five year period 1975-79. By analysing the cited literature, it is possible to identify where, when, by what subject area and in which countries the items were published. Such a study can identify important periodicals in a given field for the selection and acquisition in academic and research libraries to meet the present day needs of researchers and scholars.

In addition to the preparation of a ranked list of journals frequently used by the Phytomorphologists, the study attempts to find out:

1) the principal bibliographic forms occurring in the cited literature;
2) the geographical distribution of cited documents;
3) the proportion of English and non-English language documents;
4) the obsolescence of literature; and
5) the subject dispersion of cited literature.

2 SOURCE JOURNAL

For the purpose of this study, the periodical entitled Phytomorphology of the International Society of Plant Morphologists was selected. The Society was founded at the Joint Session of the 38th Indian Science Congress and the first Pan-Indian Ocean Science Congress held at Bangalore in January 1951 with the chief objective of promoting international co-operation in the study and diffusion of knowledge in the fields of plant morphology, anatomy and embyrology.

To promote the above objective, the society started the Phytomorphology, a quarterly publication. The periodical, since its inception in 1951, has been publishing original articles and reviews on recent work in Phytomorphology and related subjects. It has also been publishing book reviews and biographical accounts of eminent botanists.

3 ANALYSIS

Five volumes of Phytomorphology (V. 25-29; 1975-79) were selected and their citations fully analysed. Book reviews and biographical notes were excluded from the study. These volumes contained 270 scientific communications which had between them 5533 citations. Table 1 gives a volume-wise analysis of the number of citing articles and cited documents. It is surprising to note that these five volumes do not contain a single 'short communication' which is a common feature in other sciences. For example, the ratio between main articles and short communications in the field of Phytopathology[1] is 52:48, whereas in the field of Chemistry[2], it is 71:29.

TABLE 1

Distribution of source data

Volume	Year	No. of citing articles	Cumulative No. of citing articles	No. of cited articles	Cumulative No. of cited articles
25	1975	52	52	1521	1521
26	1976	55	107	892	2413
27	1977	55	162	1004	3417
28	1978	57	219	1111	4528
29	1979	51	270	1005	5533
Total		270		5533	

TABLE 2

Types of documents cited

Forms of Literature	No. of citations	Percentage	Cumulative citations	Cumulative percentage
Periodicals	4,363	78.8541	4,363	78.8541
Books	970	17.5311	5,333	96.3852
Theses/Dissertations	94	1.6988	5,427	98.084
Conference Proceedings	80	1.4459	5,507	99.5299
Preprints	22	0.3976	5,529	99.9275
Technical Reports	4	0.0723	5,533	99.9998
Total	5,533	99.9998		

31 Cited Documents

Table 2 contains the analysis of six categories of documents cited by all the 270 articles. Out of the 5533 citations, 4363 (78.85%) are for periodicals. This strengthens the universal belief concerning literature use habits of scientists i.e., the most frequently used of all sources of information are periodicals. The other major source of information for Phytomorphologists are monographs, accounting for 17.53% of total citations. In other words, periodicals and books together meet 96.38% of their total information needs. The remaining 3.62% information requirements are met by theses, conference proceedings, preprints and technical reports.

311 Journals cited most frequently

The identification of the most important periodicals cited by Phytomorphology is one of the primary objectives of this study. Table 3 presents a listing, in ranked order, of the

TABLE 3

Ranking list of cited periodicals

Sl. No.	Rank No.	Name of the Journal	Country	No. of citations	Cumulative Citations	Percentage of citations	Cumulative percentage of citations
1	2	3	4	5	6	7	8
1	1	Am J Bot (1914)	USA	352	352	8.0678	8.0678
2	2	Phytomorphology (1951-)	India	328	680	7.5177	15.5855
3	3	Ann Bot (1887-)	UK	143	823	3.2775	18.8630
4	4	Bot Gaz (1875-)	USA	135	958	3.0942	21.9572
5	5	C R Hebd Scanc Acad Sci (Paris) (1835-)	France	129	1087	2.9566	24.9138
6	6	Planta (1925-)	Germany	104	1191	2.3836	27.2974
7	7	Can J Bot (1929-)	Canada	101	1292	2.3149	29.6123
8	8	New Phytol (1902-)	UK	76	1368	1.7419	31.3542
9	9	J Indian Bot Soc (1923-)	India	69	1437	1.5814	32.9356
10	10	Physiol Pl (1948-)	Denmark	64	1501	1.4668	34.4024
11	11	Ann Sci Nat Bot Boil Veg (824-)	France	60	1561	1.3752	35.7776
12	11	Nature (1869-)	UK	60	1621	1.3752	37.1528
13	12	Proc Indian Acad Sci B (1934-)	India	55	1676	1.2606	38.4134
14	13	Bull Torrey Bot Club (1870-)	USA	53	1729	1.2147	39.6281
15	14	Bull Soc Bot Fr (854-)	France	52	1781	1.1918	40.8199
16	15	Bot Rev (1935)	USA	51	1832	1.1689	41.9888
17	15	J Linn Soc Bot (1855-)	UK	51	1883	1.1689	43.1577
18	16	J Cell Bio (1955-)	USA	44	1927	1.0084	44.1661
19	17	Z Pflanzenphysiol (1909-)	Germany	43	1970	0.9855	45.1516
20	18	Protoplasma (1926-)	Germany	42	2012	0.9626	46.1142

Table 3 (contd.)

1	2	3	4	5	6	7	8
21	19	Flora, Jena (1818-)	Germany	40	2052	0.9168	47.0310
22	19	Science, N Y (1883-)	USA	40	2092	0.9168	47.9478
23	20	Ber D Tsch Bot Gas (1883-)	Germany	35	2127	0.8022	48.7500
24	20	Pl Physiol (1926-)	USA	35	2162	0.8022	49.5522
25	20	Stain Technol (1926-)	Switzerland	35	2197	0.8022	50.3544
26	21	Acta Bot Neerl (1952-)	Netherlands	34	2231	0.7792	51.1336
27	21	Caryologia (1948-)	Italy	34	2265	0.7792	51.9128
28	22	J Exp Bot (1950-)	UK	33	2298	0.7563	52.6691
29	22	Revue Cytol Biol Veg (1955-)	France	33	2332	0.7563	53.4254
30	23	Ann Rev Pl Physiol (1950-)	USA	30	2361	0.6876	54.1130
31	23	Plant Syst Evol (1858-)	Austria	30	2391	0.6876	54.8006
32	24	Proc Nat Inst Sci. India B(1935-)	India	27	2418	0.6188	55.4194
33	25	J Arnold Arbor (1919-)	USA	26	2444	0.5959	56.0153
34	26	J Cell Sci (1966-)	UK	24	2468	0.5500	56.5653
35	27	Beitr Biol Pflanzen (1870-)	Germany	23	2491	0.5271	57.0924
36	27	J Ultrastruct Res (1957-)	USA	23	2514	0.5271	57.6195
37	28	Proc Nat Acad Sci (1915-)	USA	20	2534	0.4584	58.0779
38	28	Proc Roy Soc, Lond (1854-)	UK	20	2554	0.4584	58.5363
39	29	Aust J Bot (1953-)	Australia	19	2573	0.4354	58.9717
40	29	Bot Not (1839-)	Sweden	19	2592	0.4354	59.4071
41	29	Revue Gen Bot (1889-)	France	19	2611	0.4354	59.8425
42	30	Bot Jaarb (1889-)	Belgium	18	2629	0.4125	60.2550
43	31	Blumea (1934-)	Netherlands	17	2646	0.3896	60.6446
44	31	Bot J Linn Soc (1855-)	UK	17	2663	0.3896	61.0342
45	31	Svensk Bot Tidskr (1907-)	Sweden	17	2680	0.3896	61.4238
46	32	Biol Rev (1926-)	UK	16	2696	0.3667	61.7905
47	32	Exp Cell Res (1950-)	USA	16	2712	0.3667	62.1572
48	32	Grana Palynol (1954-)	Sweden	16	2728	0.3667	62.5239
49	33	Bot Mag (1887-)	Japan	15	2743	0.3438	62.8677
50	33	Taxon (1951-)	Netherlands	15	2758	0.3438	63.2115
51	34	Bio Chem Physiol Pflanz (1970-)	Germany	14	2772	0.3208	63.5323
52	34	Dokl Akad Nauk SSR (1922-)	USSR	14	2786	0.3208	63.8531
53	34	Heriditas (1920-)	Sweden	14	2800	0.3208	64.1739
54	34	Ind J Exp Biol (1963-)	India	14	2814	0.3208	64.4947
55	34	Symp Soc Exp Giol (1947-)	UK	14	2828	0.3208	64.8155
56	35	Am Fern J (1910-)	USA	13	2841	0.2979	65.1134
57	35	Ann Sci Uni Reims ARERS ( )	France	13	2854	0.2979	65.4113
58	35	Bot Zh (1932-)	USSR	13	2867	0.2979	65.7092
59	35	Bryologist (1898-)	USA	13	2880	0.2979	66.0071
60	35	Develop Biol (1959-)	USA	13	2893	0.2979	66.3050
61	35	Euphytica (1952-)	Netherlands	13	2906	0.2979	66.6029
62	35	K Svensk Vetensk-Acad Handl(1739-)	Sweden	13	2919	0.2979	66.9008
63	35	Palaeobotanist (1952-)	India	13	2932	0.2979	67.1987
64	36	Acta Soc Bot Pol (1923-)	Poland	12	2944	0.2750	67.4737
65	36	Bot Ztg (1843-)	Germany	12	2956	0.2750	67.7487
66	37	Acta Horti Bergiani (1890-)	Sweden	11	2967	0.2521	68.0008
67	37	Aust J Biol Sci (1953-)	Australia	11	2978	0.2521	68.2529
68	37	Biologia Pl (1959-)	Czechoslovakia	11	2989	0.2521	68.5050
69	37	Genetics; Princeton (1916-)	USA	11	3000	0.2521	68.7571
70	37	J Agric Res (1913-49)	USA	11	3011	0.2521	69.0092
71	37	Lloydia (1938-)	USA	11	3022	0.2521	69.2613
72	37	Proc Crop Sci Soc (1929-)	Japan	11	3032	0.2521	69.5134
73	37	Virology (1955-)	USA	11	3044	0.2521	69.7655
74	38	Evolution,N Y (1947-)	USA	10	3054	0.2292	69.9945
75	38	Naturwissenschaften (1913-)	Germany	10	3064	0.2292	70.2237
76	38	Phyton,B Aires (1951-)	S America	10	3074	0.2292	70.4529
77	38	Proc Linn Soc,NSW (1844-)	Australia	10	3084	0.2292	70.6821
587		Other titles (each having citations less than 10)			1279		29.3179
664		Grand Total			4363		100.0000

77 most heavily cited periodicals which account for 70.68% of the citations. The remaining 29.32% of the periodical literature is contributed by as many as 557 journals.

For each title listed in the rank list, its starting year and country of origin are given. It also gives the number of citations for each title. The titles which share the same rank are listed in alphabetical order. Although the total number of periodicals cited by Phytomorphology is 664, only the first 77 are listed here taking into consideration that each has been cited at least ten times.

From the rank list (Table 3) it can be ascertained that the American Journal of Botany (1914-) occupies the first rank accounting for 352 citations. Phytomorphology (1951-) itself, although started 37 years after the American Journal of Botany contributed 328 citations. If it were to be started little earlier it could have surpassed the American Journal of Botany in the number of citations. The titles listed in the table indicates that except Phytomorphology none of them is exclusively devoted to the subjects of morphology, anatomy or embryology of plants.

312 *Productivity of cited journals*

Table 4 groups the cited periodicals into three categories according to their productivity. 50% of the literature used by the Phytomorphologists is covered by only the first 24 periodicals. The remaining 50% of the literature used is covered by 640 journals. It can further be analysed that 75% of the literature requirements are met by 108 journals. That means, the required information in the field is cattered in a large number of periodicals.

32 *Country-wise distribution of cited documents*

321 *Cited periodicals*

The countries of origin of all periodicals could not be ascertained from the citations themselves. These were obtained from the World List of Scientific Periodicals (Ed. 4, 1964), Ulrich's International Periodicals Directory (Ed.18, 1979-80), and Serial Sources for the BIOSIS Data Base (1981).

TABLE 4

Productivity of cited periodicals

Sl. No.	Category	No. of citations	Percentage among the periodical citations	Cumulative Percentage
1	First 24 titles	2197	50.00	50.00
2	Next 84 titles	1079	25.00	75.00
3	Remaining 556 titles	1087	25.00	100.00
Total		4363	100.00	

TABLE 5

National origin of the cited periodicals

Country	No. of titles	Percentage of titles	No. of citations	Percentage of citations
1	2	3	4	5
USA	154	23.1928	1241	28.4437
Germany	78	11.7470	493	11.2996
UK	69	10.3916	587	13.4540
India	65	9.7892	648	14.8521
France	49	7.3795	392	8.9846
Japan	41	6.1747	123	2.8192
USSR	28	4.2169	76	1.7419
Netherlands	24	3.6145	125	2.8650
Italy	17	2.5602	65	1.4898
Sweden	12	1.8072	97	2.2232
Switzerland	12	1.8072	55	1.2606
Canada	11	1.6566	117	2.6816
Belgium	10	1.5060	15	0.3438
Austria	7	1.0542	39	0.8939
Denmark	7	1.0542	74	1.6961
S.America	7	1.0542	24	0.5501
China	6	0.9036	18	0.4126
Czechoslovakia	6	0.9036	19	0.4355
S.Africa	5	0.7530	7	0.1604
Bulgaria	5	0.7530	5	0.1146
Poland	5	0.7530	20	0.4584
Australia	4	0.6024	43	0.9856
Israel	4	0.6024	5	0.1146
Malaysia	4	0.6024	4	0.0917
Newzealand	4	0.6024	10	0.2292
Norway	4	0.6024	9	0.2063
Phillipines	4	0.6024	15	0.3438
Ireland	3	0.4518	9	0.2063
Taiwan	3	0.4518	5	0.1146
Cuba	2	0.3012	2	0.0458
Hungary	2	0.3012	2	0.0458
Indonesia	2	0.3012	5	0.1146
Portugal	2	0.3012	2	0.0458
Spain	1	0.1506	2	0.0458
Yugoslavia	1	0.1506	4	0.0917
Finland	1	0.1506	1	0.0229
Jawa	1	0.1506	1	0.0229
Nigeria	1	0.1506	1	0.0229
Rhodesia	1	0.1506	1	0.0229
Singapore	1	0.1506	1	0.0229
Srilanka	1	0.1506	1	0.0229
Total	664	99.9998	4363	99.9997

Table 5 shows the geographical distribution of 664 titles among 41 countries. It can be seen from the table that USA, Germany, UK, India, France, Japan, USSR, and Netherlands produce 508 titles which account for more than 76% of the total number of periodicals used by Phytomorphologists. These periodicals have contributed 85.28% of the total number of citations. Only 14.72% of the citations are from periodicals originate the other 33 countries put together.

322 *Books cited*

Table 6 reinforces the data contained in Table 5. The first 7 countries (given in Table 6) namely, the USA, UK, India, France, Netherlands and USSR producing 93.3% of monographic literature used by the Phytomorphologists. The remining 2/3 of the countries together have produced only 6.7% of the books useful to them.

TABLE 6

Countrywise distribution of cited books

Country	No. of citations	Cumulative No. of citations	Percentage of citations	Cumulative percentage of citations
USA	304	304	31.3402	31.3402
UK	261	565	26.9072	58.2474
Germany	150	715	15.4639	73.7113
India	89	804	9.1752	82.8865
France	47	851	4.8454	87.7319
Netherlands	42	893	4.3299	92.0618
USSR	12	905	1.2371	93.2989
Canada	10	915	1.0309	94.3298
Australia	9	924	0.9278	95.2576
Malaysia	8	932	0.8247	96.0823
Poland	8	940	0.8247	96.907
Japan	6	946	.6186	97.5256
Sweden	6	952	.6186	98.1442
Austria	3	955	0.3092	98.4534
Czechoslovakia	3	958	0.3092	98.7626
Denmark	3	961	0.3092	99.0718
Italy	3	964	0.3092	99.381
Belgium	2	966	0.2062	99.5872
Africa	2	968	0.2062	99.7934
Switzerland	1	969	0.1031	99.8965
S.America	1	970	0.1031	99.9996
Total	970		99.9996	

TABLE 7

Countrywise distribution of theses/ dissertations

Country	No. of citations	Cumulative No. of citations	Percentage of citations	Cumulative Percentage of citations
India	39	39	41.4893	41.4893
France	22	61	23.4042	64.8935
USA	14	75	14.8936	79.7871
Germany	6	81	6.3829	86.1700
UK	4	85	4.2553	90.4253
Netherlands	4	89	4.2553	94.6806
Sweden	2	91	2.1276	96.8082
Australia	1	92	1.0638	97.8720
Phillippines	1	93	1.0638	98.9358
Malaysia	1	94	1.0638	99.9996
Total	94		99.9996	

323 *Cited theses*

Table 7 gives the geographical distribution of cited theses. More than 79% of them are from India (41.5%), France (23.4%) and USA (14.9%). From the Tables 5, 6 and 7 it is clear that USA occupies the first place as far as the cited periodicals and books are concerned. It occupies the third place in the case of Theses literature used. Here, India gets the first place accounting for 39 theses out of 94. This may be due to the non-availability of theses to other scholars working elsewhere. A large number of theses are never published, with the result, they never reach wider audience. It is precisely for this reason the UGC Review Committee had recommended financial assistance to universities for the publication of doctoral theses[3].

4 LANGUAGE-WISE DISTRIBUTION OF CITED DOCUMENTS

41 *Journal Literature*

Table 8 attempts to analyse the languagewise distribution of cited periodicals. Since it was too difficult to find out to which particular language the cited periodical article belongs, the periodical literature, other than English have been grouped into only one category. The table shows that the English is by far the most common language, accounting for 3709 citations (85.055%). The citations in all other languages put together account for 654 citations(14.941%).

42 *Monographic Literature*

The languagewise distribution of 970 cited books is given in Table 9. Among the cited books, 755 (77.5%) are in English, 130 (13.4%) are in German and 53 (5.5%) are in French.

TABLE 8

Journal literature:English vs. Other languages

Language	No. of citations	Cumulative No. of citations	Percentage of citations	Cumulative percentage of citations
English	3709	3709	85.055	85.055
Other languages	654	4363	14.945	100.000
Total	4363		100.000	

TABLE 9

Languagewise distribution of cited books

Language	Number of citations	Percentage of citations
Czech	2	0.2061
Dutch	7	0.7216
English	755	77.8350
French	53	5.4639
German	130	13.4020
Italian	3	0.3092
Japanese	1	0.1030
Polish	8	0.8247
Russian	7	0.7216
Swedish	4	0.4123
Total	970	99.999

TABLE 10

Date of publication of cited articles in periodicals

Period	No. of citations	Cumulative citations	Percentage of citations	Cumulative percentage of citations
1	2	3	4	5
1979	10	10	0.2292	0.2292
1978	45	55	1.0314	1.2606
1977	70	125	1.6044	2.865
1976	123	248	2.8191	5.6841
1975	157	405	3.5984	9.2825
1974	204	609	4.6756	13.9581
1973	228	837	5.2257	19.1838
1972	209	1046	4.7902	23.974
1971	220	1266	5.0424	29.0164
1970	226	1492	5.1799	34.1963
1969	200	1692	4.5840	38.7803
1968	173	1865	3.9651	42.7454
1967	158	2023	3.6213	46.3667
1966	140	2163	3.2088	49.5755
1965	130	2293	2.9796	52.5551
1964	148	2441	3.3921	55.9472
1963	147	2588	3.3692	59.3164
1962	121	2709	2.7733	62.0897
1961	83	2792	1.9023	63.992
1960	84	2876	1.9252	65.9172
1950-59	634	3510	14.5312	80.4484
1940-49	236	3746	5.4091	85.8575
1930-39	202	3948	4.6298	90.4873
1920-29	119	4067	2.7274	93.2147
1910-19	82	4149	1.8794	95.0941
1900-09	76	4225	1.7419	96.836
1890-99	46	4271	1.0543	97.8903
1880-89	29	4300	0.6646	98.5549
1870-79	20	4320	0.4584	99.0133
1860-69	14	4334	0.3208	99.3341
1850-59	9	4343	0.2062	99.5403
1840-49	9	4352	0.2062	99.7466
1830-39	5	4357	0.1146	99.8611
1820-29	5	4362	0.1146	99.9757
1810-19	1	4363	0.0229	99.9986
1800-09				
18th century				
Total	4363		99.9986	

This again indicates that publications in English language are the most commonly used ones.

5 CHRONOLOGICAL SCATTERING OF CITED DOCUMENTS

The citations to periodicals and books have been chronologically arranged in TAble 10 and 11 respectively. The citations dated 1960-79 have been tabulated by year, whereas citations dated 1800 to 1959 have been tabulated by decade; citations dated before 1800 are not sub-divided.

51 Cited Periodical Articles

Table 10 provides information concerning the dates of publications of periodical articles by various time periods. A total of 4363 periodical articles were cited. The table shows that about 52.5% of the cited periodical articles were published during 1965-1979, and approximately 65.9% of the citations were to periodical articles published between 1960 and 1979. It is to be noted here that the number of citations to periodical literature goes on decreasing backwards. For example, there are 634 citations (14.53%) in the 1950's which came down in 1930's (4.63%) and in 1920's (2.73%). This data should be useful to the librarians in the acquisition of back volumes of periodicals.

52 Cited Books

Table 11 provides the dates of publication of books similar to the periodical articles. The table shows that approximately 50% of the citations were to books published during the period 1964 to 1979, and approximately 58% were to books published between 1960 and 1979. Further, there are as many as 270 books published during the four decades viz., 1920's, 1930's, 1940's and 1950's accounting for 27.83% citations. Comparing this data with that of periodicals, it can be inferred that scientists refer to much older monographic literature (27.83%) than periodical literature (12.77%).

6 SUBJECT DISPERSION

Table 12 indicates the subject dispersion of serial titles and that of citations. The information regarding the subject headings/or subheadings to which these periodicals belong was not available in the citations themselves hence they have been taken from the Ulrich's

TABLE 11

Dates of publication of cited books

Period	Number of citations	Cumulative citations	Percentage of citations	Cumulative percentage of citations
1	2	3	4	5
1979	3	3	0.3092	0.3092
1978	5	8	0.5154	0.8232
1977	22	30	2.2680	3.0912
1976	27	57	2.7835	5.8747
1975	28	85	2.8865	8.7612
1974	42	127	4.3298	13.0910
1973	45	172	4.6391	17.7301
1972	37	209	3.8144	21.5445
1971	46	255	4.7422	26.2667
1970	34	289	3.5051	29.7918
1969	38	328	4.0215	33.8133
1968	33	361	3.4020	37.2153
1967	15	376	1.5463	38.7616
1966	47	423	4.8453	43.6065
1965	29	452	2.9896	46.5965
1964	37	489	3.7113	50.3078
1963	21	510	2.1649	52.4727
1962	26	536	2.6804	55.1531
1961	21	557	2.1649	57.3180
1960	15	572	1.5463	58.8643
1950-59	136	708	14.0206	72.8849
1940-49	43	751	4.4329	77.3178
1930-39	60	811	6.1855	83.5033
1920-29	31	842	3.1958	86.6991
1910-19	10	852	1.0309	87.7300
1900-09	21	873	2.1649	89.8949
1890-99	16	889	1.6494	91.5443
1880-89	17	906	1.7525	93.2968
1870-79	21	927	2.1649	95.4617
1860-69	11	938	1.1340	96.5917
1850-59	7	945	0.2216	97.3133
1840-49	4	949	0.4123	97.7856
1830-39	8	957	0.8247	98.5503
1820-29	4	961	0.4123	98.9626
1810-19	2	963	0.2061	99.1687
1800-09	1	964	0.1030	99.2717
18th century	6	970	0.6185	99.8902
Total	970		99.8902	

TABLE 12

Subject dispersion of journal titles & citations

Subject Area of Journals Cited	Journal Titles			Journal Citations		
	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
1	2	3	4	5	6	7
General	10	1.5060	1.5060	18	0.4125	0.4125
Agricultural Sciences	83	12.5000	14.006	190	4.3548	4.7673
Biological Sciences						
Biology	76	11.4458	25.4518	460	10.5432	15.3105
Biochemistry	21	3.1627	28.6145	66	1.5127	16.8232
Biophysics	2	0.3012	28.9157	2	0.0458	16.8690
Biostatistics	2	0.3012	29.2169	2	0.0458	16.9148
Botany						
General	201	30.2711	59.488	1940	44.4648	61.1379
Physiology	17	2.5602	62.0482	217	4.9736	66.3532
Pathology	7	1.0542	63.1024	10	0.2292	66.5824
Palynology	5	0.7530	63.8554	13	0.2979	66.8803
Embryology	1	0.1506	64.006	1	0.0229	66.9032
Cytology & Histology	16	2.4096	66.4158	143	3.2775	70.1807
Anatomy & Morphology	3	0.4518	66.8674	332	7.6094	77.7901
Ecology	3	0.4518	67.3192	4	0.0916	77.8817
Genetics & Evolution	24	3.6145	70.9337	160	3.6672	81.5489
Experimental Studies	5	0.7530	71.6867	53	1.2147	82.7636
Taxonomy	5	0.7530	72.4397	21	0.4813	83.2449
Paleobotany	5	0.7530	73.1927	27	0.6188	83.8637
Microbiology	10	1.5060	74.6987	32	0.7334	84.5971
Molecular Biology	2	0.3012	74.9999	35	0.8022	85.4192
Microscopy	6	0.9036	75.9035	69	1.5814	87.0005
Zoology	4	0.6024	76.5059	5	0.1146	87.1196
Chemistry	3	0.4518	76.9577	3	0.0687	87.1883
Geology	4	0.6024	77.5601	6	0.1375	87.3258
Medical Sciences	4	0.6024	78.1625	6	0.1375	87.4633
Food Science	1	0.1506	78.3131	1	0.0229	87.4862
Science						
General	134	20.1807	98.4938	535	12.2622	99.7250
Natural & Physical Sciences	10	1.5060	99.998	12	0.2750	100.0000
Total	664	99.998		4363	100.0000	

International Periodicals Directory (Ed.18, 1979-80). There is no separate subject heading for plant morphology in this directory, but it is combined with anatomy. The other related heading is embryology. It can be seen from the table that there are only 4 periodicals belonging to these areas. Only a very small number of citations (7.63%) refer to these periodicals. A further analysis indicates that 43.37% of periodical titles are scattered throughout the other branches of botany. The remaining 56.02% of the periodical titles belong to Agricultural, Biological, Medical and General Sciences.

It has already been pointed out that the periodicals belonging to Emrbyology and Anatomy and Morphology carry 7.63% of the total citations. The periodicals belonging to all other branches of Botany together score 59.32% citations. The remaining 33.05% citations referred to Agricultural, Biological, Medical and General Sciences.

According to Table 12, the subject dispersion of serial titles as well as the subject dispersion of the citations is too high.

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USERS SURVEY OF SOIL CONSERVATION RESEARCH INSTITUTE LIBRARY

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A users survey was conducted to evaluate the library resources of the Central Soil & Water Conservation Research & Training Institute, Dehra Dun, through a questionnaire. The returns have been analysed and the results are presented in this paper. Such surveys can be helpful in future developments of the library.

INTRODUCTION

A research library aims at supporting the research need of the parent organization. Research libraries have to be catalysts in the process of continuous development. About a century ago, when research output and its users were limited in number, it was quite easy to examine and evaluate the collection of a library in the light of the aims and objectives of its parent organization. Literature explosion by way of vast amount of research output and tremendous increase in the number of its users have made the libraries of today highly complex and complicated. All these have made it necessary to conduct, from time to time, users surveys to measure the adequacy of collection, its effectiveness and the usefulness of other facilities and services.

The Central Soil Conservation Institute has a small but specialized library which caters to the needs of scientists and technicians with varied fields of interest such as Engineering, Agronomy, Soil Science, Economics, Extension, Statistics and so on.

OBJECTIVES

The dual objective of the present study is firstly to determine the usefulness, adequacy of the collection in the library, its internal organization and maintenance and its relevance to the aims and objectives of the parent organization; and secondly, to make a comprehensive study of the needs and the expectations of the users and suggest suitable modifications.

SCOPE OF THE SURVEY

This survey was confined to the scientists and technicians of varying status, viz. scientists S-4, S-3, S-2, S-1 and technicians T-6, T-5, T-4, T-3, etc. The administrative and supporting staff members of the organization were excluded.

RESULTS AND DISCUSSION

The data gathered by means of a questionnaire especially designed for the purpose. A total of 55 questionnaire forms were distributed among the users, out of which 42 responded. The succeeding sections give an analysis of response and the results of the survey.

It is evident from Table 1 that largest part of the responding population was scientist S-1 and above (45.3%), followed by technical assistants and above (35.7%) and scientist S-3 and above (19%).

Table 1. Identification of users

Particulars	Number	% out of 42
Scientist S-3 and above	8	19.0
Scientist S-1 and above	19	45.3
Technical Asstt. and above	15	35.7

Table 2 presents a view of users' interest in various fields of study. It is evident that maxium users (23.8%) consult the library for Soil Science literature followed by Engineering (21.4%), Statistics (16.7%) and Agronomy (14.3%). Almost every discipline has its users.

PURPOSE OF VISITING THE LIBRARY

Three purposes were clearly identified for the users for coming to the library, namely i) to borrow books, ii) consultation of reference material, and iii) casual visit.

The survey revealed that 5 users came regularly, 22 occasionally and 14 seldom for borrowing library books. Similarly for consultation of reference material, 10 users came regularly, 22 occasionally and 9 seldom. For casual visit, 6 users came regularly, 17 occasionally and 13 seldom. It seems that users have a tendency to come to the library, the purpose may be different.

TOTAL COLLECTION

The opinion of the users regarding the collection of journals/books in the library, in various categories was sought. The results are presented in Table 4.

This table shows the adequacy or otherwise of various types of documents in the collection. Regarding the collection of journals, 10 users thought they were adequate, while 17 thought them to be moderately adequate and 11 considered the collection inadequate. In the case of books, 7 users stated the collection as adequate, 18 moderately adequate and 17 as inadequate. Regarding maps, 6 users stated them to be adequate, 10 moderately adequate and 19 inadequate. Back volumes of journals were adequate for 6 users, moderately adequate for 12 users and inadequate for 19 users. Regarding reprints, 5 users stated them as adequate, 12 moderately adequate and 19 as inadequate. For the collection of reference books, theses and reports, most of the users stated that they were inadequate. This reveals that acquisition of reference books, theses, reports, etc. has been getting secondary importance in the library.

Table 2. Area of users interest

Subjects	No. of persons	% out of 42
Soil Science	10	23.8
Agronomy	6	14.3
Horticulture	1	2.3
Botany	2	4.8
Engineering	9	21.4
Statistics	7	16.7
Economics	2	4.8
Extension	1	2.3
Forestry	2	4.8
Plant Breeding	2	4.8

Table 3. Purpose of visit

Purpose	Number		
	Regularly	Occasionally	Seldom
To borrow books	5	22	14
Consultation of reference material	10	22	9
Casual visit	6	17	13

Table 4. Opinion of users

Types of documents	Adequate	Moderately adequate	Inadequate
Journals	10	17	11
Books	7	18	17
Maps	6	10	16
Back volumes of journal	6	12	19
Reprints	5	12	19
Reference books	2	16	20
Theses	1	4	28
Reports	1	14	22

BOOK SELECTION PROCEDURE

Opinions were sought on three common methods of book selection in the library. Detailed information about users opinion on this aspect is provided in Table 5.

This Table shows that 35.7% of the users were of the opinion that they should independently recommend titles for acquisition whereas 16.6% are of the opinion that

Table 5. Users opinion regarding book selection

Particulars	Number	%out of 42
Users should independently recommend the titles for procurement	15	35.7
Concerned Heads of Divisions should decide the utility of each recommended title	7	16.6
Choice of title should be users own whereas the approval of the Head of Division should be obligatory.	20	47.6

concerned Head of Division should decide the utility of each recommended title. Most of the users (47.6%) suggest that choice of titles should be users own whereas the approval of the Head of Division should be obligatory. It is evident that users want more autonomy in selecting titles whereas Head of Division's role is secondary.

PROBLEMS OF AVAILABILITY OF BOOKS IN THE LIBRARY

Detailed information regarding problems of availability of books and their causes is presented in Table 6.

Table 6. Availability of books

Particulars	Number	% out of 42
Less number of appropriate titles are available	12	25.6
Delay due to misplacement within the library	0	00.0
Keeping books overdue by some readers	26	61.9
Delay in purchase of indented titles	4	9.5

Table 7. Late returning of books, users opinion and remedy.

Particulars	Number	% out of 42
Late return should normally be fined on per day basis	4	9.5
Membership of such users may be stopped	5	11.9
Limited number of borrowers ticket should be issued	25	59.5
Present system be continued without charge	8	19.5

Table 8. Books required to be with the user (in no.)

Particulars	Number	% out of 42
More than 1 but less than 4	13	31.0
More than 4 but less than 8	24	57.1
More than 8	5	11.9

The survey reveals that 25.6% users could not get the required books because of inadequate number of appropriate titles available in the library, whereas 61.9% users complained that non-availability was more due to keeping books over-due by some readers. 9.5% users stated that there was delay in purchasing the indented books. It is evident from the Table that large number of users (61.4%) made a complain about non-availability of books due to late returning of books by some users.

It is evident that the majority of users feel that limited number of borrowers ticket should be issued to every user so that only limited number of books can be borrowed against such tickets, whereas users do not want fine system to be introduced for late return of books.

Thus, on the question of number of books allowed to be borrowed by a reader, most of the users (57.1%) wanted 4 to 8 books to be with them. Some users (11.9%) wanted more than 8 books at a time, as the most convenient number.

READING ROOM FACILITY

Best utilization of a library depends, to a great extent, upon its reading room facility. Reading room of a library should be cosy and comfortable. Table 9 reveals the opinion of users regarding the reading room of the Institute.

The analysis clearly reveals that 42.9% of the users did not like the present sitting arrangement, whereas there was no problem with the lighting arrangement in the reading room.

Table 9. Reading room facility

Particulars	Number	% out of 42
Sitting arrangement not conducive to reading	16	38.1
Proper lighting system not available	1	2.4
Present sitting arrangement with long tables makes a crowd of readers hence not conducive.	18	42.9
No problem with present system	7	16.6

LIBRARY SERVICE REQUIRED

To assess the nature of library services that will be most desirable, opinions on five specific services were sought. Table 10 shows the choice of services identified by users priority-wise.

The response clearly reveals that 47.6% of the users give top priority to S.D.I. service, followed by current awareness service (23.8%). Less number of users are interested in indexing and abstracting and inter-library loan services.

Table 10. Priority of services

Particulars	Number	% out of 42
S.D.I service	20	47.6
Current awareness service	10	23.8
Xerox	8	19.00
Indexing and Abstracting	2	4.8
Inter-Library loan	2	4.8

CONCLUSION

Number of regular visitors to the library is not much. Overall collection of all types of literature is not completely adequate. Efforts should be made to improve the collection. Emphasis should be given on reports, theses, and reference books. Limited number of borrowers ticket should be issued to every user according to his legitimate need. Present sitting arrangement may be changed because it is not conducive to the readers. Users should be given more freedom for suggesting new titles for acquisition. S.D.I. service and current awareness service etc. be introduced without any further delay.

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COMPUTERIZATION OF THE NATIONAL UNION CATALOGUE OF SCIENTIFIC SERIALS : PLANNING AND ORGANIZATION OF INPUT DESIGN*

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Describes the development towards compilation of the National Union Catalogue of Scientific Serials. Several constraints in processing the Union Catalogue data by conventional or manual method are mentioned. Objectives of computerization are highlighted. Analyses the feature elements of serial publications keeping in view the objectives. Principles of designing codes of feature elements are elaborated. Principal input designs and their functions are explained.

1. INTRODUCTION

A national union catalogue of scientific serials is an indispensable tool to support the document supply model developed by Insdoc. The fundamental philosophy of this model is to help in development of an effective national interlending system and to exploit the serial resources of the country. Not only this model will support Insdoc's document supply service, but also help other important institutions to play an active role in the decentralised document supply system for the country. The compilation of the serial data would also be an essential requirement for a national stock taking of the serial resources in the country and would supply valuable data for planning and funding acquisition programmes. With these objectives in view, the project has been given high priority and has been planned to complete the basic data collection in a reasonable span of time which involved handling of massive holdings data of scientific serials.

The compilation and publication of the National Union Catalogue of Scientific Serials has therefore been an on-going project of Insdoc, beginning from 1965. The plan envisaged to bring out the Catalogue has been on schedule and also been well monitored. The work carried out so far has been in two phases. In the first phase, during 1965 to 1978, the main tasks were of the holdings data collection after physical varification for accuracy, editing, organization of several index files and publication of Catalogues/Regional Union Catalogues. The data represented the holdings of libraries with fairly significant build up of serials collection. This work was handled from 1965 in two stages. The first stage without computer aided processing was carried out during 1965 to 1971 and the second stage from 1973 to 1978, computer facility has been utilized for data processing.

In the first phase till 1978, seventeen volumes of catalogues containing holdings data of about 30,000 scientific serials in 530 libraries located in different parts of the country have been published. A computer data base has also been created containing information of 24,000 titles with holdings information of 330 libraries.

In the second phase since 1978 it has been planned to compile revised and up-to-date holdings data from 530 libraries and to collect holdings data of another 270 libraries for bringing out the National Union Catalogue of Scientific Serials.

2. PLANNING FOR COMPUTERIZATION

It has been a very useful experience in bringing out twelve volumes of Catalogues/Regional Union Catalogues during 1965 to 1971 by conventional method. The limitations of handling the data by this method are outlined:

(1) holdings data collected from various regions cannot be processed simultaneously;

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(2) final editing and the preparation of the press copy of the catalogue can be undertaken in a manner of only one catalogue at a time;

(3) information collected goes out of date before the press copy of the catalogue is finalised for publication; and

(4) after the press copy of the catalogue is finalised, any additional and revised information received from participating libraries in the form of supplement, cannot be incorporated immediately unless revised edition of the catalogue is brought out, which is not planned at the moment.

In addition, it would be a stupendous task to prepare the press copy of the National Union Catalogue containing the holdings information of about 40,000 titles on completion. Moreover, while processing the press copy for succeeding catalogues, it has been noticed that about 50 or 60 per cent of titles found common in the earlier catalogues. This percentage of common entries has been on increase with the publication of subsequent catalogues. The time taken for editing of common titles, to some extent, can be saved but the drudgery and work-load of routine procedure connected with the preparation of press copy could not be avoided.

In view of the above facts, computerization of the project has been given serious consideration. Following objectives have been kept in view while planning the operation:

i) to create a data base of scientific serials held in participating institutions in machine readable form, e.g. on magnetic tapes/disks;
ii) to expedite the publication of the forthcoming regional catalogues by repeated use of common entries of the data base;
iii) to undertake input preparation of the holdings information simultaneously received from various regions;
iv) to incorporate required feature elements in the coded form in the entries so as to facilitate to generate different files out of the data base, e.g. classified, sponsor, country of publication indexes, individual library holdings, and holdings of group of specialised libraries etc.
v) to undertake revision and updating of the data continuously on magnetic tapes/disks in order to consolidate the information;
vi) to obtain the consolidated print-out of the National Union Catalogue immediately after completion of input preparation of data collected from participating libraries; and
vii) computer print-out can be used as master for photolitho printing.

Some other aspects, such as, pattern of the catalogue, output format of the main part and indexes, form of entry etc., have been examined in detail while developing the input design. It has been felt absolutely necessary to identify the feature elements of the entry which would play an important role in fulfilling the objectives of computerization.

3. PATTERN OF THE CATALOGUE AND THE FEATURE ELEMENTS

The main part of the catalogue consists of main entries with holdings and cross-reference entries, arranged in one alphabetical sequence by title of the serials. Filing of the titles follows a set pattern of rules as followed in "World List of Scientific Periodicals", 4th ed, 1960. However, acronyms are taken as words and alphabetised accordingly. International conferences and symposia are rendered under their official English names, and arranged alphabetically in the main part.

The elements of the main entry are i) title of the serials; ii) sponsoring body; iii) imprint; iv) bibliographical note; and v) library symbols with respective holdings information. These elements are to appear in the same order in each main entry. All these elements in an entry are required to be related with the title and to be filed alphabetically according to the title. For the purpose of generation of index files, titles only have to be selected from the entries. To build up the individual libraries or holdings of group of specialised libraries files, the relevant entries have to be identified by the titles only. Therefore, title is considered to be main or key feature element. Similarly the sponsoring body, the subject heading, and the country of publication (country heading) are to be identified from the entries and are termed as sub-feature elements for the generation of files of classified, sponsor, and country of publication indexes respectively. It may be a complicated situation for machine to identify and to select the titles for the generation of different files, because these feature elements are variable in length and character. Therefore, in any machine readable system, the feature elements are required to be identified by fixed-length characters at the fixed position in the input unit.

Principles of designing codes of various feature elements of serials publications have been explained by Porter (1) in computerization of the British Union Catalogue of Periodicals: New Periodical Titles (BUCOP:NPT). In addition, some working experience in the data preparation of BUCOP : NPT, immensely helped to adopt almost similar principles in designing codes of feature elements for the National Union Catalogue.

4. DESIGNING OF CODES

Considerable time and effort were involved in designing codes of feature elements, e.g. 1) Title; 2) Sponsor; 3) Subject heading and 4) Country of publication.

41 Title Code

Title code or Record code is designed on the principle that it should be unique fixed-digited code for each title, and the application of the code will also help in filing the entries according to a desired alphabetical pattern. "ASTM Coden for Periodical Titles" was thoroughly scrutinised before developing a new system. "ASTM Coden" provides a six-digited alpha code which is unique for each title, but fails to satisfy the requirement with regard to its role for filing the titles according to desired alphabetical pattern. Therefore, it is considered to be worthwhile to design a new code which can serve the purpose of a dual role as an identifier and a record sorter. For this purpose "World List of Scientific Periodicals (WLSP) 4th ed, 1960", which contains information of about 80,000 titles is taken as base. In addition, about 20,000 titles covered in twelve volumes of catalogues published during 1965 to 1971 are transferred on cards and consolidated into a central file (CF) and about 60% titles of CF are found to be common with the WLSP. A Seven-digited alpha-numeric code has been designed for title code or record code. The first digit of the code consists of a letter which represents the first significant word of the title followed by six-digited numeral. This set of numerals determines the position of the title in relation to other titles in the same alphabet. The titles in the CF, already arranged in the desired pattern are assigned codes in relation to the titles of the WLSP in an ascending order of numerals. In order to accommodate new titles, adequate gaps in numbers in between two titles have been provided for future use (Fig.1). Also to overcome the bottleneck to accommodate new titles, in certain cases, a block numbers of 1000 or sometimes 2000 are kept reserved after every 1000 to 2000 titles in the CF. Thus, all the titles in the CF are assigned codes, and the code numbers for the remaining titles in the WLSP can readily be assigned.

42 Sponsor Code

The sponsor code has to play the dual role similar to that of title code. This code is unique for each sponsoring body and will help sorting the headings in the desired alphabetical sequence A six-digited alpha-numeric code has been designed for sponsor code. The first digit of the code consists of a letter which represents the first significant word of the heading followed by five-digit numerals. This set of numerals, determines the position of the heading in relation to other headings in the same alphabet. To start with, all the sponsoring bodies consisting of main headings and the cross reference headings so far appeared in twelve volumes of published catalogues, are arranged in one alphabetical sequence. All these headings in the consolidated file numbering about 15,000 are assigned codes in the ascending order of numerals. However, adequate gaps in numbers are kept reserved after every 500 to 1000 headings for future use. Against the main headings, if necessary, the codes of the cross reference headings are tagged, so that when a sub file of the sponsoring bodies is generated, a print-out of the same can be obtained (Fig.2). On comparing the print-out with the consolidated file, it is possible to identify the cross reference headings required for building up of the Sponsor Index file.

Fig.1 TITLE CODE

Sample Data

Code	Title of Serials
A 103470	ACTIVITIES AT TURRIALBA
A 104220	ACTULIDADES BIOLOGICAS
A 106470	ACTUALITES BOTANIQUES
A 107620	ACTUALITIES PHARMACOLOGIQUES
A 107820	ACTUALITIES SCIENTIFIQUES ET INDUSTRIELLES
A 108020	ACUSTICA
A 108320	ADA FORECAST
A 108570	ADANSONIA
A 108720	ADDICTIONS
A 108820	ADDISONIA
A 109220	ADHAESION
A 109320	ADHESIVES AGE
A 109420	ADHESIVES AND RESINS
A 109520	ADIRONDACK COTTAGE SANATORIUM (SARANAC LAKE, N.Y) REPORTS. SEE ANNUAL MEDICAL REPORT, TRUDEAU SANATORIUM
A 109620	ADMINISTRATION REPORT. SEE REPORT
A 109650	ADMINISTRATIVE MANAGEMENT
A 109820	ADMINISTRATIVE MEDICINE-TRANSACTIONS OF THE CONFERENCE
A 109920	ADMINISTRATIVE SCIENCE QUARTERLY
A 110120	ADRENAL CORTEX-TRANSACTIONS OF THE CONFERENCE
A 110220	ADVANCE ABSTRACTS OF CONTRIBUTIONS OF FISHERIES AND AQUATIC SCIENCE IN INDIA
A 110420	ADVANCE REPORT, BUREAU OF MINES, QUEBEC
A 110520	ADVANCE THERAPY
A 110530	ADVANCED ENERGY CONVERSION. SEE ENERGY CONVERSION
A 110540	ADVANCED MANAGEMENT. SEE SAM ADVANCED MANAGEMENT JOURNAL
A 110640	ADVANCED MANAGEMENT JOURNAL. SEE SAM ADVANCED MANAGEMENT JOURNAL
A 110920	ADVANCEMENT OF SCIENCE.

43 Subject Heading Code

Universal Decimal Classification scheme has been used to classify the titles of serials. UDC numbers consisting of digits, symbols and punctuation marks cannot be sorted in a logical sequence by computer. Therefore UDC numbers require conversion into machine readable form by a fixed-field code of uniform characters. One UDC schedule (Abridged English Edition 1961; 3rd ed; B.S. 1000A 1961) has been completely coded by six-digited numeric code numbers in the sequence of main/sub classes. Adequate gaps in numbers in between preceeding and succeeding class numbers have been provided in the schedule, so that suitable codes can be assigned for further division of the class numbers. In view of the subjects to be covered, in the National Union Catalogue, provision for accommodating majority of numbers has been kept under the main classes of 5 and 6 of UDC.

A broad outline of the block code number allotted against block class number of UDC is given below:-

Block class Number	Block code Number
0 to 499	000001-099999
5 to 535.9	100000-199999
536 to 549.9	200000-299999
55 to 579.9	300000-399999
58 to 599.9	400000-499999
6 to 621.039.7	500000-599999
621.039.8 to 629.67	600000-699999
63. to 663.67	700000-799999
663.8 to 691.189	800000-899999
691.2 to 999	900000-999999

In generation of the classified file the titles having same subject heading codes are consolidated and are sorted alphabetically. The common code is converted in the form of UDC number with appropriate subject heading with the help of a subject heading dictionary file (Fig.3).

44 Country of Publication Code

Each country name in the UDC place schedule has been assigned a three-digited numeric code in an ascending order. The country of publication code is assigned to every record or entry, except the reference entries which are not to be indexed. The titles along with the country of publication codes are

Fig.2 SPONSOR CODE
Sample Data

Code	Sponsor Heading
185200	INTERNATIONAL ROAD FEDERATION
185250	INTERNATIONAL RUBBER REGULATION COMMITTEE
185350	INTERNATIONAL RUBBER STUDY GROUP
185501	INTERNATIONAL SCHOOL OF SUBNUCLEAR PHYSICS
185540	INTERNATIONAL SCIENTIFIC RADIO UNION. 191620, U03550
I85600	INTERNATIONAL SEISMOLOGICAL CENTRE
I86800	INTERNATIONAL SOCIETY OF ART AND PSYCHOLOGY
I86900	INTERNATIONAL SOCIETY OF AUDIOLOGY. S38050
I87000	INTERNATIONAL SOCIETY OF BIOCLIMATOLOGY AND BIOMETEROLOGY.SEE INTERNATIONAL SOCIETY OF BIOMETEOROLOGY
I87100	INTERNATIONAL SOCIETY OF BIOMETEOROLOGY. I87000
I87200	INTERNATIONAL SOCIETY OF BLOOD TRANSFUSION
I87300	INTERNATIONAL SOCIETY OF CARDIOLOGY
I87400	INTERNATIONAL SOCIETY FOR CELL BIOLOGY
I87500	INTERNATIONAL SOCIETY OF GASTROENTEROLOGY
I87600	INTERNATIONAL SOCIETY OF HEMATOLOGY
I87700	INTERNATIONAL SOCIETY FOR HUMAN AND ANIMAL MYCOLOGY
I87800	INTERNATIONAL SOCIETY OF LEATHER TRADES CHEMIST SEE SOCIETY OF LEATHER TECHNOLOGISTS AND CHEMISTS (LONDON
I88000	INTERNATIONAL SOCIETY OF NEPHROLOGY
I88100	INTERNATIONAL SOCIETY FOR PHOTOGRAMMETRY
I88300	INTERNATIONAL SOCIETY OF PLASTIC SURGEONS. SEE INTERNATIONAL CONFEDERATION FOR PLASTIC AND RECONSTRUCTIVE SURGERY
I88400	INTERNATIONAL SOCIETY OF ROCK MECHANICS
I88730	INTERNATIONAL SOCIETY OF SUGAR CANE TECHNOLOGISTS
I88750	INTERNATIONAL SOCIETY OF CANE TECHNOLOGISTS, PATHOLOGY SECTION
I88900	INTERNATIONAL SOCIETY FOR TERRAIN VEHICLE SYSTEMS
I89100	INTERNATIONAL SOCIETY OF UROLOGY. S38650
I89150	INTERNATIONAL SOLAR ENERGY SOCIETY. S58650
I89200	INTERNATIONAL STATISTICAL INSTITUTE. I36750
I89300	INTERNATIONAL SUGAR COUNCIL.

identified for the generation of the country of publication code file. The country of publication code is also used in assigning a subject heading code which requires further classification by country. After generation of the country of publication index file, the codes are converted by the country names with the help of country of publication code dictionary file (Fig.4).

5. INPUT DESIGN

For mechanization of any bibliographic record, proper understanding about the problems of the project on the part of the Systems Analysis Group is essential. The objectives and requirements for computerization of the project are explained to the Systems Analysis group of Insdoc in detail. Various types of problems connected with the entries are put forward with varied examples, so as to facilitate the Group to have proper understanding to the intricacies. Based on these problems and requirements, the Group undertook designing the system compatible to batch mode of IBM 360/44 computer. Sample data of about 500 entries are coded according to preliminary card designs and data are key-punched on to 80 column punched cards. Before the sample data are put to test, it has been decided to obtain the output of main part entries and indexes in twenty eight characters per line in three column format. Therefore, at the coding stage, it is possible to have control

Fig.3 SUBJECT HEADING DICTIONARY
Sample Data

Code	Subject Heading
100200	5/6 SCIENCE AND TECHNOLOGY
100210	5/6:061-6 RESEARCH INSTITUTIONS
100215	5/6:82.03 TECHNICAL TRANSLATION
100230	5/6 (043) DISSERTATIONS
100262	5/6 (091) HISTORY OF SCIENCE
100265	5/6 (092) SCIENTISTS BIOGRAPHY
100400	5 MATHEMATICS AND NATURAL SCIENCES
101240	502.7 NATURE AND WILD LIFE
102280	51+53 MATHEMATICS AND PHYSICS
102300	51+531 MATHEMATICS AND MECHANICS
102360	51/56 PHYSICAL SCIENCES
102370	51/54 MATHEMATICS AND CHEMISTRY
102380	51/53 MATHEMATICS, ASTRONOMY AND PHYSICS.
102400	51 MATHEMATICS
102600	511 ARITHMETIC
108400	512 ALGEBRA
110000	512.9 TENSOR
110200	513 GEOMETRY
112600	513.8 NON-EUCLIDEAN, MULTIDIMENSIONAL AND OTHER FORMS OF GEOMETRY
112800	513-83 TOPOLOGY
113000	514 TRIGONOMETRY. POLYGONOMETRY
118000	516 ANALYTICAL AND CO-ORDINATE GEOMETRY
118200	516.1/.4 CLASSICAL ANALYTICAL GEOMETRY
122000	517 ANALYSIS. CALCULUS.

Fig.4 COUNTRY OF PUBLICATION CODE DICTIONARY
Sample Data

UDC No.	Code	Country
(100)	001	International Organizations
(410)	213	Great Britain
(417)	264	Ireland
(430)	359	Germany
(436)	394	Austria
(437)	405	Czecheslovakia
(438)	408	Poland
(439.1)	413	Hungary
(44)	414	France
(45)	457	Italy
(46)	482	Spain
(469)	497	Portugal
(480)	520	Finland
(481)	521	Norway
(485)	522	Sweden
(489)	523	Denmark
(492)	526	Netherlands
(493)	532	Belgium
(494)	542	Switzerland
(495)	546	Greece
(497-1)	553	Yugoslavia
(497.2)	554	Bulgaria
(498)	555	Rumania
(51)	560	China
(512.317)	564	Hong Kong
(519)	573	Korea
(520)	577	Japan
(540)	597	India
(548.7)	632	Sri Lanka
(549)	635	Pakistan
(549.3)	641	Bangladesh

over the end of each line either to split or to take the word to the next line. The outcome of several experiments of the sample data leaves sufficient scope for further modifications and changes. After extensive experimentation and development of software, 15 card designs are finalised for conversion of data.

The structure of different card designs, development of relevant software package for input and output have been detailed by Murty & Arora (2). Card Design (CD) 41-49 are meant for coding the main entry and cross reference entry data. CD 50 is for coding the holdings. In case of CD 42-49, the 80 column punched cards are divided broadly in three fields. In the first field the card columns (CC) 1-22 contain all the relevant codes of the entry. The second field CC 23-78 contain the text matter which is to appear in the publication. In this field CC 50 is the controlling point for each line in the text portion, so that the matter should be limited upto this point or before, or logically split the words into two for further continuation to the next line on CC 51-78. The CC 79 has been left blank. The third field CC 80 contains the sequence number of continuation cards (0-9). For CD 41-55, CC 1-2 is represented by two digit card design codes, i.e. 42 and 43 for titles, 44-47 for sponsoring body, 48 for imprint and 49 for bibliographical note. Rest of the card designs, i.e., 41, 50, 52, 53, 54 and 55 have been dealt with separately.

For CD 41-50, CC 3-8 contain two digit coder's code and a four-digited serial number. This helps to retrieve the data from coding sheet for incorporating necessary correction or deletion before the data is key-punched. As such, these codes are not generated on magnetic tapes. The seven-digited alpha-numeric title code is coded on CC 9-15 for all CD 41-49. Further, in case of CD 44-47 the six-digited alpha-numeric sponsor code is coded on CC 16-21 and CC 22 left blank. But in remaining card designs except CD 41 and 43, CC 16-22 are left blank. The entries pertaining to each card design from 42-49 must contain title code. The other feature elements and specialities of the entry are coded in the summary card (CD 41). The card designs namely Summary card (CD 41), Holdings data (CD 50), Cross reference to sponsoring body index (CD 52), Cross reference entry to individual library file (CD 55), are explained further.

6. SUMMARY CARD (CD 41)

This design incorporates all the salient features of the entry in the coded form. It is programmed to check the codes and accordingly search for relevant card designs. Like other card designs, CC 1-2 contain card design number 41; CC 3-8 contain two-digited coder's code and four-digited serial number of the record. CC 9-15 contain the title code, on CC 16-18 is coded the country of publication code, and CC 19-24 contain the subject heading code. CC 25 is coded with 1 or 2 for a main entry or cross reference entry. In case of a main entry, CC 27 is coded with 1,2 or 3 to indicate presence of the sponsor's name with title, sponsor present separately, or sponsor completely absent. Thus it helps to identify the sponsor from CD 44 and 46. Maximum provision for including two sponsoring bodies in the entry has been made. For one sponsoring body 1 is coded on CC 28, and 2 for two sponsoring bodies. It has also been considered whether the sponsoring body appears in the main part has to appear in the same manner in the index or not. If it appears in the same manner number 1 is coded on CC 29 then CD 44 or CD 44 and 45 are necessary. If sponsor appears differently in index, CD 46 or CD 46 and 47 are needed alongwith CD 44 or CD 44 and 45 in case number 2 is coded on CC 29. Accordingly for index purpose CD 30 is coded with number 1 for one sponsor and number 2 for two sponsors and number 3 for sponsor not present. For presence or absence of bibliographical note is coded as 1 or 2 on CC 31. Only in case of 1 coded on CC 31, CD 49 will be needed.CC 34 is coded with 1 or 2 in case of a current or a ceased serial. With the help of this it is possible to ascertain the total number of current titles in the file. If necessary, it may be possible with the help of CC 34 for further manipulation to generate files of current titles only.

Not all the cross reference entries require to be indexed. CC 26 is coded with number 1, if the entry is to be indexed. Cross reference entry, not needed for index, CC 26 is coded with number 2. Then CC 30 will indicate the presence or absence of sponsoring body in the index by coding 1 or 2 for presence of one or two sponsors, and 3 for absence of sponsor.

The summary card is read while loading the data and the required feature element codes as well as the related card designs are checked. If all the necessary items are available in a proper sequence and position then the record is loaded on magnetic tape. Otherwise, if anything is found incorrect or not in appropriate position then the data relating to that particular record is not loaded.

7. HOLDINGS INFORMATION (CD 50)

This design is different from the main entry card designs (42-49). Representation of both title code and library symbol are absolutely necessary while coding the holdings data of each library. A six-digited library symbol consisting of capital letters of Romal alphabet has been designed for each participating library. For operating the related programmes, the 80 column punched card is divided into seven fields. First field, CC 1-2 is coded by card design number 50. Second field, CC 3-8 contains two-digited coder's code and four-digited serial number for each library holdings information. Third field, CC 9-14 is coded with a six-digited alpha code which also represents the library symbol. Fourth field, CC 15-21 contains the title code of the corresponding holdings information. Fifth field, CC 22 is either coded by 1,2 or 3 to indicate different types of holdings. Number 1 indicates the complete set without any missing or incorplete volume, number 2 indicate the partial holdings, i.e. holdings right from beginning or from intermediate point, but having missing or incomplete volumes, and number 4 indicates stray holdings having only one or two volumes or only a few issues of a serial.This type of catagorization in holdings is made with a view to print only complete holdings or both complete and partial holdings with the main entry, if needed. Sixth field, CC 23-62 contain the holdings data. CC 42 and 62 are the controlling points for logically breaking the holdings data or further continuation to succeeding line. Seventh field, CC 80 is coded by 0 to 9 as the case may be to govern the sequence of cards for each holdings information.

8. CROSS REFERENCE TO SPONSORING BODY INDEX (CD 52)

While generating the sponsor index file, the sponsoring body headings along with the related titles are selected from the entry file. The sponsoring body headings are shown under the latest known names or the vernacular forms of names. There is no scope in the system to incorporate cross reference headings from earlier known names or the variant names in the sponsoring body headings file. This form of cross reference headings is provided externally in the system. Evidently CD 52 has been designed for this purpose. After ascertaining the cross reference headings required for the file, the data is coded. The main fields in the design are CC 1-2 contain the card design (CD 52). CC 3-8 contain coder's code and a four-degited serial number for the record. On CC 9-14 are left blank. CC 23-78 contain the sponsoring body headings as it should appear in the index; and CC 79 is kept blank. As usual CC 80 has been kept for determining the sequence of continuation cards (0-9).

There are two more card designs meant for generating subject heading dictionary (CD 53) and country of publication code dictionary (CD 54) respectively. The structure and function of these designs are simple. Coding of subject headings dictionary (CD 53) is done with card design number 53 on CC 1-2. On CC 3-8 contain coder's code and new serial number. On CC 9-14 is coded by a six-digited subject code, and CC 15-22 are left blank. CC 23-78 are coded with UDC number and corresponding subject heading, leaving a space blank in between two items. In case of country of publication code dictionary, CC 1-2 contains the card design number 54. On CC 3-8 is coded coder's code and new serial number, and on CC 9-11 is coded with country of publication code. CC 12-22 are left blank, and CC 23-78 contains the country of publication code with name of the place/country. As usual, for both the above mentioned designs theCC 79 is left blank and CC 80 is coded to indicate the sequence of continuation cards (0-9).

9. CROSS-REFERENCE ENTRY TO INDIVIDUAL LIBRARY HOLDINGS FILE (CD 55)

It is planned to bring out catalogues of individual participating libraries from entry file and holdings file. It has already been mentioned that holdings file is generated as a separate unit, but information coded for each library's holdings is always accompanied by the corresponding title code. The data base of the entries of serials is matched with the holdings file. The holdings file is first sorted by title-code-wise and then by library-symbol-wise. This matching of two files generates the main part for a union catalogue. To bring out catalogue of individual library, the holdings file is resorted first by library-symbol-wise and then by title-code-wise. The new file consists of main entries with corresponding library holdings. There will be serious lacunae, if earlier title held by the library and the alternate title reference are not accounted for along with the main entries. The provision of earlier title or alternative title reference will invariably vary from one library catalogue to other depending upon the holdings information. At the time of consolidating the library holdings information, it is given considerable importance to indicate the cross reference title code against the concerned library symbol in the main entry slip, if the library holdings has covered for earlier title. Therefore, this card design is meant for coding the data of cross reference entries required for individual library catalogue. CC 1-2 consist of card design number 55, and CC 3-8 contain two-digited coder's code and four-digited serial number. On CC 9-14 is coded with the library symbol, and on CC 15-21 is coded with cross reference title code. CC 22 is coded with number 4 to differentiate it from other types of holdings information. The additional data of cross reference title codes are incorporated in the holdings file. The file is sorted first by library symbol-wise and then by title-code-wise. The file now generated contains the codes for main entries and cross reference entries in a sequence under each library symbol.

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BOOK REVIEW

Brevity of notation in Dewey decimal classification scheme by John P. Comaromi and Mohinder Pratap Satija. New Delhi, Metropolitan Book Co., 1983. xiii, 87p. Board bound. Price: Rs.60.00/$12.00 (Reviewed by S.K. Sen).

A complete book on brevity of notation and that too for a particular classification scheme appears to be queer at the first instance and asks for reasonable support of justification. However, going through the 77+10 (for notes and index) pages of its content the present reviewer feels that the work done by Comaromi and Satija is worthy enough of our attention.

Notation or symbolic representation of a classificatory system is very important in general; more so when such a system is more or less arbitrarily set up and used for frequent retrieval purposes.

The authors of this small book start their disposition with discussion of notational brevity in general and almost throughout the book they have leaned heavily to Ranganathan's works on notation.

The first three chapters of the book (pp.1-33) deal with the general background discussions on brevity and other related features of notation. The fourth chapter (pp.34-75) deals with the central theme of the title. A short but independent section (pp.69-70) has been devoted to retroactivity of notation.

It was both a stroke of genius and luck that Dewey hit upon the Decimal number notation. The whole structure of DDC rests upon this notation. The authors have admirably summarised the history of this notational achievements of Dewey. But progress brings their own problems and DDC notation has been no exception. Thanks to the authors that they have dwelt on that aspect also.

The attributes of a notational scheme which directly or indirectly go in favour or against brevity are expressiveness, coordination, retroactivity, simplicity, mnemonics and hospitality. In fact, discussion on brevity involves almost all aspects of classificatory notation. Presumably, the authors could also comprehend this early and have attempted an overall background discussion covering at least some of these aspects.

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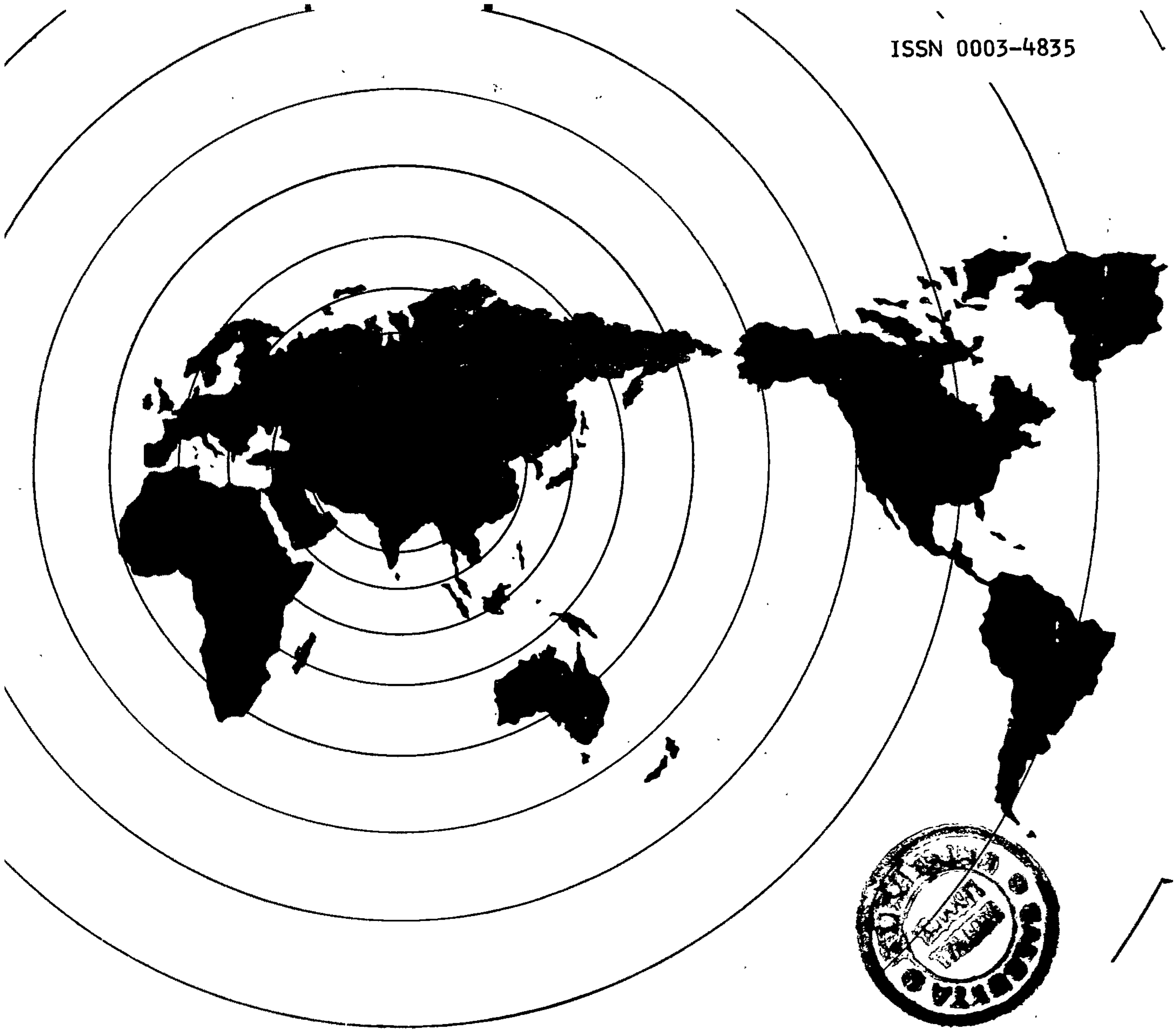

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A FOURFOLD BIBLIOMETRIC EVALUATION OF JOURNALS FROM LESS DEVELOPED SCIENTIFIC COUMMUNITIES – THE PATTERN OF REFERENCES IN MEDICAL JOURNALS FROM YUGOSLAVIA

S. MARICIC
Research Library of National and University Library
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An objective and feasible evaluation of scientific journals from Less Developed Scientific Communities (LDSC) is needed (i) in order to build indigenous self-regulation with positive selection, while (ii) enhancing two-way journal-links with international science. The available methods are described and divided into two groups: (I) those which rest on the existing selections by sponsoring bodies and various secondary and teritary information services, whose evaluative approaches are generally not known, and (II) the analytical methods. These methods are studied in relation to medical journals in Yugoslavia

1 INTRODUCTION : Setting the Scene

Ziman[1] describes the scientific journal as an integral part of the scientific consensus. In a recent paper relevant to our subject[2], it was restated that primary journals are corner stones of the edifice of science, to the effect that "the exploitation of the research journal is what separates the 'hard' from the 'soft' sciences".

On the whole, none doubts that (i) the attainment of consensus in science is inseparable from the practices of publishing publicly and (ii) that this mechanism "refers to the scientific world at large – to international science"[2].

The last quotation calls for a precise mean- ng in terms of contemporary reality. What is e "scientific world at large"? Does it com- ise (all?) scientists as individuals, or their ocio-) scientific communities? Morrison[2] ms to identify tacitly the "international science" with the leading research front. However, "In smaller and somewhat isolated scientific communities, difficulties can arise which lead to introspection and concern about locally published journals"[2].

A rough search of the literature[3,4,5,6,7,8] showed that this concern about "locally published journals" is quite noticeable: the world's inhomogeneity is reflected in scholarly publishing. This, after all, is not an unexpected phenomenon in spite of the international character of science.

The "force-field" of international science is manifested in two interrelated ways upon journal publishing in less-developed-scientific-communities (LDSC).

Firstly, there are vastly different local microsociological climates favouring anything from isolationism (parochialism) to top-level science "peaks". The latter are embedded in the international science (journals), but almost exogenous to the local setting. Whatever the causes of various "polarizations" in response to the international science ("field"), there is an obvious need to define, i.e. to evaluate the local *scientific* journals. Strange as it may seem, it is mainly the problem of eliminating those journals that are *not* scientific, thereby promoting the more scientific ones.

Secondly, there are direct linkages with international science through the best "core" journals published in LDSC. In order to increase the input of indigenous scientific information into the secondary communication channels, thus strengthening LDSC's participa-

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An extended abstract of a part of this and another study was published (with N. Gruden and Vajdicka) in Periodicum biologorum, 1981, 83(3), 332-3.

tion in international science, a selection of best journals from LDSC's is sought for, implying, again, an evaluation beforehand.

This second aspect has particularly been sharpened nowadays by the well established Current Contents and Citation Indexes of the Institute for Scientific Information (ISI) from Philadelphia. Striving for international recognition, scientists from LDSC tend to publish preponderately abroad[5]. Even a new "terminology" related to the problem is appearing in the literature, like: "island-sciences..[8] "overseasia" and "apron strings in science publishing"[7]. While the cause of these effects are deeply rooted in the socio-political and historical environment of LDSC's, the specific influence of secondary, especially citation indexes, does not help to improve the circumstances, to say the least. The problem was succinctly stated by Saracevic[9], though, in another context: "...in an evolutionary way the new information systems aimed at controlling the literature are changing the shape of literature itself", to which we added the question "how, and to whose benefit?"[10]. Garfield[11] explained how they select journals in ISI, but the debate is still on[12]. The last few references illustrate what we called a "force-field" to which LDSC's are exposed.

However, we address in this study the general problem of evaluating the scientific merit of journals published by less developed scientific communities. The aim is to develop a coherent and as objective a method as possible to identify journals which cannot be claimed as scientific at all, on one hand, and those that can be relied upon as being most scientific, on the other. A technique is sought for, which will mainly rely on LDSC's indigineous capacities to evaluate their journals, but in the light of the international character of science and its "force-field".

2. THE GENERAL APPROACH : Objectivity versus Relevance

This subsection title is taken from Narin[13], who used the expression to put the techniques for studies of scientific advance "into a rational perspective". The full line in Fig. 1 is a reproduction of his qualitative interdependence between the relevance to true measures of scientific advances (the ordinate) and the objectivity of the techniques used (the abscissa). In Narin's words, "Underlying the figure is an analogy to the Heisenberg uncertainty principle in quantum physics... Between... extremes lie combinations of techniques from which a satisfactorily relevant and satisfactorily objective study of research advances can be designed".

Now, while the analogy with the Heisenberg uncertainty principle is a purely formal one (because there is no perturbance of the system under study by the observer), the basic idea of Narin's seemed very useful for the present study, too. Superimposed on the qualitative original relationship given by Narin, there are in Fig. 1, equally qualitative, objectivity vs. relevance points for various techniques "measuring" the scientific merit of *journals,* as we see them.

Each point in Fig.1. represents one particular way of evaluating journals' scientific merit. It should be emphasized that we have defined them from an "inventory" of the present state-of-the-art especially with regard to journals from LDSC's.

The points in Fig. 1, form two groups which differ between themselves by the method the journals have been or could be evaluated:

> To the left of Fig.1 is a group of points 1-5, which "defies" the "uncertainty principle" in journals evaluation. All of them belong to the already *existing selections* of journals as a result of one or another kind of mostly undefined methodologies. In case our approach (right in Fig. 1, i.e. a,b,c, S) yields a coherent, satisfactorily objective and relevant methodology, this (left) group of points should eventually vanish from Fig.1 through application of the new methodology.

> The other set of points in Fig. 1 (a, b, c ar S) is characterized by research-analyti methods, and they conform with the curve depicting the objectivity-relevance uncertainity.

The particular positioning of each point as well as this division of them into two groups was achieved by a subjective assessment of their characteristics along the line of Narin's paper[13], as described below.

21 *The Existing Selections*

Point 1 (Fig.1) refers to the least objective and least relevant way of selecting scientific (and professional) journals in a *LDSC,* that of subsidizing them through public research funds. The selections made by various working parties of scientists may be subject to doubt especially when the subject-fields are too limited to provide for a sufficiently high scientific critical level. On the other hand, while the ranking of journals within a subject-field is almost impossible, this kind of selection proved to be useful for a very rough separation into scientific (and professional) and "other" journals[14].

Domestic (national and professional) bibliographies settle in due time for a more or less definite selection of source journals, but no clear evaluation methodology seems to exist. A slightly more objectivity was asigned to point 2 because of lack of personal interest in the selection procedure on the part of the staff.

The downward arrow indicates a further uncertainty ascribing a greater relevance to scientific merit (character) for journals in various domestic bibliographies, particularly in the subject-oriented ones.

Special abstracting services are expected to exercise greater selectivity as to the scientific merit of their source journals, and a greater objectivity, too. If not for anything else, the latter because of the financial side involved. The two arrows symbolize the uncertainty as to the scientific merit. Namely, there are basically two different *domestic* abstracting services: (a) those aimed at local users, published in the LDSC's language, for which the selection may be less stringent and more tailored according to professional's requirement (hence the downward arrow); (b) those for the "international market", published in foreign language(s).

While points 1-3a relate to the domestic coverage, 3/b is the first step towards the international scene (hence an upward arrow). However, in none of the cases thus far has a well-defined selection policy been known, though, a proper research on this point is in place. Notwithstanding its outcome it seems quite reasonable to assume that the higher one moves along the "relevance" axis of Fig.1, the more stringent will be the list of the LDSC's journals, thus ensuring at least the first scan, from which to begin a deeper ranking analysis.

This group (point 4) comprises journal selections by foreign (international?) abstracting or bibliographic services (nowadays data bases), including Current Information, Philadelphia (ISI). As to the selection-objectivity, there is no particular enhancement: although the "judges" are certainly freer from subjective local (LDSC) bias, other biases like language for instance are operative. At any rate, we are not aware of any publicized journals evaluation methodology on the part of the respective managements (for a similar view see ref.[15]), especially with regard to LDSC's scientific production.

With No. 4, following 3/b, the "offer" of LDSC's journals to the "international market" is completed.

At least two examples of using the (a) extent and (b) depth in secondary coverage for estimating the quality of journals from LDSC's may be quoted: for (a) Toth and Pravdic[16] analyzed some Yugoslav journals as to the number of secondary services they are being covered by, whereas for (b) Mendez et al.[17] studied the percentage of all articles from nine Spanish food journals covered by seven secondary publications. This approach (No. 4 in Fig.1) is one of the three simultaneous ones suggested by Dhawan et al.[18] in a model for evaluation of scientific journals.

Point 5 concerns the citation indexes. Presently, it is the only available source (provided by ISI) from which to judge on the degree of "visibility" of the "stock" offered to the "international market". We are concerned here with journals as aggregate scientific information units. To judge the strength of the link by those from LDSC's with the international science, Journal Citation Reports from ISI is indispensible. It is also used in the model by Dhawan et al.[18] as their second approach (the third being journals usage data). The latter model enables one to distribute the journals (as it is suggested here somewhat similarly - along the relevance axis in Fig. 1) into seven ranked subsets.

It should be pointed out at this point, that all these approaches for journals evaluation are useful, but one has to bear in mind that the already *established* selections of journals are taken for granted, which is highly questionable with regard to journals from LDSC's, because their evaluation, which is the primary concern, is obscured.

We have shown earlier[19] that there are journals from LDSC which would fare better by the very *citation analysis*, although they are *not* in the ISI selection, than quite a number of those that *are* source journals for Citation Indexes (See also refs.[10, 11, 12]). A similar criticism has been propounded for non-LDSC journals by Narin (on p. A-15 in ref.[20]). There is no doubt that ISI covers the hard (Bradford) core of journals which define the "research front"[21], because otherwise it could not have fulfilled its basic aim - the efficient retrieval means through the information "morrass" of the research front. To quote Garfield[22]. "... The SCI covers more than 3000 journals, far more than 1000 core journals but far less than the total number of journals published, which is at least 10000..." It is this "outer-shell" of journals into which some from LDSC's are incorporated. In the building stage of the ISI data-base these were "unearthed" through the references to them from the hard-core source journals. Undoubtedly, these are most integrated in the international science and as such may be regarded as most scientific, but bearing in mind that others may have become as valid if not more, while still others (especially some newly founded) entered the ISI selection by not quite clear evaluative criteria. It is precisely this point - inclusion of some LDSC journal into the ISI selection - which places this approach (No. 5 in Fig. 1) in our scheme so low on the objectivity axis for the LDSC(!) journals.

22 *Subsets of LDSC-journals by Nos. 1-5*

Hence, using the available journals-selections, (and partly the technique [a] from Fig.1, as applied in ref.[14] - see later) one may evaluate

- the broadest set of domestic (LDSC's) scientific and professional journals according to 1, 2, 3 and [a], and
- the most stringent subset of the LDSC's scientific journals according to 4 and 5; Frame et al.[23] found that the international coverage of the SCI compared with the coverage of a few other abstracting and indexing services is reasonably free from bias, but the method of comparison was not described.

(In favourable cases several ranking-subsets[18] could be delineated within this, given framework).

The shortcomings of this procedure are:

- only a rough division is possible without well defined criteria for the lower quality cut-offs;
- the strictest selection of scientifically most valid journals appears distorted when reflected back to the original LDSC journals set[19, 10];
- whereas in the broadest subset all the subject fields will be represented if they publish journals, in the strictest selection some disciplines may be left out without a valid reason.

Most of bibliometric studies including those quoted here rely heavily on points 4 and 5 in our Fig. 1. For the LDSC's journals, the situation is reminiscent of the story in which a drunkard is looking for his lost keys under a street lamp because the light happens just to be there, although he lost the keys elsewhere. Rabkin and Inhaber [4] point out the difficulties with data limitations and suggest "...to study directly the scientific journals of peripheral countries (our notation: LDSC) which are not included in ISI editions".

We shall therefore turn now our attention to the right in Fig. 1 for the following.

Research-analytical methods

In this section we define points a,b,c and S in

Fig. 1 for which a greater degree of objectivity is expected with differences in their scientific relevance.

Point a is ascribed to characterization of LDSC - journals by their publishing modes and physical appearence. Among the pertinent descriptive parameters are those which reflect to a good deal the "scientific climate" around the journal. Although most important, the information on whether there is any and what is the refereeing procedure is usually missing. The other information bearing on the "scientific climate" is:

- the type of the publisher or the editorial board; for the purpose of a rough scanning the journals may be divided to two groups[14]: (i) those published by learned societies and research institutions, and (ii) those from industry, professional/technical societies or communal organizations;
- periodicity, regularity and up-to-datedness are at least a reflection of the creative capacity in the particular scientific setting which is in principle (but not a priori) a guarantee of its scientific merit;
- publishing the articles in English (or in other world (?) languages) or at least the abstracts and/or content page is a positive sign of a desire to communicate within the world's system of scientific information (including foreign refereeing);
- endurance and continuity in publishing are in general (but not a priori) a sign of the maturity of the given LDSC.

In an analysis of this kind[24], 23-32 various parameters were recorded for each of the 70 journals subsidized by public money. In a similar analysis of over 120 medical journals from Yugoslavia[25], 12 different characteristics were estimated. The latter was made use of in this study, as described later.

Thus far these analyses accentuated the formal and technical side of the local journal publishing. It is still desirable to devise a uniform set of required data on the basis of the physical appearence of journals without resort to any questioneering. If enough data could be defined to describe reasonably well the "scientific microclimate" producing the journal, the technique (a in Fig. 1) may substantially gain in relevance as to the scientific merit (note the upward arrow at a!) while retaining its high objectivity so that it evantually replaces No.1, i.e. makes it unnecessary any more, or leaves it merely as an additional aid.

Strictly speaking these analyses are not bibliometric, but a number of the mentioned parameters are listed by Hjerppe[26] in his outline of bibliometrics and citation analysis. Although by and large the recorded data are of "yes" or "no" type, in the final analysis something is quantified, as will be shown here.

With an approximately equal objectivity (because the information contained in journals is used directly without any a priori selection) but with considerably higher relevance is the study of the pattern of references. The higher relevance to scientific merit is attributed because referencing to previous research is an inherent mechanism in scientific publication[1, 27]. However, the arrow in Fig. 1 at b indicates that this scientific relevance may be of varying degree, depending on the parameter(s) whose value is being determined.

The least relevant to scientific merit of a journal is the average number (N_r) of references per paper (or per page, see later) for a given period of publication. This is not to say that this parameter has zero-relevance (hence the position of b in Fig. 1). There is an important information, too, when there are papers without any reference. Their relative presence in a journal is a parameter of significance exploited thus far in a study of journals abstracted in Information Science Abstracts and in International Pharmaceutical Abstracts[28] and, for another case, see ref.[29]. This parameter is particularly important in defining the lowest cut-off level of scientific value for LDSC journals, which will be examplified here in concrete terms for a group of medical journals. While $N_r = 0$ is, thence, a negative indicator, for $N_r > 0$, as a positive indicator of scientific character of a journal, there is the question of quantitative relationship between N_r and the journals scientific value.

Further, the distribution of the type

n (the number of journals or their pages, or papers, having a given value of Nr) = f(unction of) N_r

proved characteristic for large samples of journals[21, 28]. The results, though not greatly used for individual journal evaluation, are valuable because of the well established statistical parameters from the pool of international science, which could be used in relative analyses for LDSC journals.

Additional enhancement of the relevance to scientific merit is obtained (for b in Fig. 1) if one disaggregates all the references into several classes. Hjerppe's review[26] is helpful in deciding on a definite number of such classes, because there is a systematic survey of almost all possible variants (see also ref.[15]). Small and Crane[30] were able to define characteristic patterns of references for high-energy physics, psychology, economic and sociology by deriving:

- the mean age of the reference separately to articles and books
- percentage of references to books
- percentage of references to publications within past five years (separately for those to articles and to books)

In the present study (see later) an additional distinction in pattern of references analysis was introduced and that is to derive the ratios of references to domestic vs. international publications. This may be of particular importance in evaluating the scientific character of LDSC journals, assuming that (at least) the one-way (passive) connection with the international science is sine qua non for a work to quality as scientific.

The important point about this kind of analysis (b in Fig. 1, and as described later in this study) is that a continuous scale in evaluating individual LDSC journals within a given subject field is possible to develop, and not, as in the papers quoted here, to devise only a lump characteristic. Besides, one can analyticaly define independent, measurable parameters, with substantial correlative interrelationship(s) to evaluate journals.

The bracket connecting a with b in Fig. 1 is a symbol to indicate possible correlations between independent approaches. Research should show to what extent a, as the simplest technique and least time-consuming, may be relied on without resort to the more sophisticated approaches through b (and c).

Point c stands for citation on analysis. It should be pointed out that the lowering in objectivity for c relative to b is depicted in Fig.1, solely for LDSC-journals, for reasons explained in the discussion of the ISI journals selection policy (see here in "Setting the scene" and in "No.5 of existing selections").

However, for those LDSC-journals whose papers may be found cited through Citation Indexes, there is no doubt that such data justify the enhancement shown in Fig.1 for c on the relevance scale. Narin[20] has convincingly documented that citation of papers (especially in aggregated samples of one kind or another) is very clearly and directly correlated with their scientific value. For LDSC-journals, Citation Indexes are not so useful just because a few of LDSC-journals may be among the ISI-source-journals. More important is the possibility offered by CI's to find the citations (from the ISI-source-journals, i.e. mainly from the "research front") to those LDSC-journals which are outside the ISI-selection, an approach developed by us for a sample of Yugoslav journals [19]. A relative impact factor is thus obtained for each journal as if it were within the ISI-selection.

Point $\mathcal{S}$ (Fig. 1) collects the opinions of most competent scientists via surveys and/or structured interviews. As to the degree of relevance for their judging the (LDSC-) journals' scientific value, this is comparable to the corresponding one from Narin's scheme[13] in case of evaluating scientific fields, or groups of scientists in them. Obviously no greater relevance could be expected than one can obtain from opinions of scientists moving the research front, or from those most qualified in LDSC's. A somewhat higher objectivity compared to Narin's scheme could possibly be expected in our case because an individual is integrating his opinion about an aggregate sample (of articles from a journal). Although there are individual authors behind each journal, the journal, as an entity representing their total scientific output, damps to a certain extent the individuals' subjective attitude.

However, as we are primarily concerned here with developing an evaluative method indigenous to LDSC's, the main problem is to define the "most competent (qualified) scientists" in the particular LDSC. The vicious circle has thus been completed. The main difficulty lies in the (usual) smallness of a LDSC. A number of leading scientists (whatever it may mean in concrete socio-scientific terms) are editors or members of the boards publishing the journals to be evaluated, so that their objectivity is not necessarily completely out of question even at this aggregate level of journals evaluation. On the other hand there is the question to what extent the scientists from LDSC who publish mostly abroad are familiar with the LDSC's journal production. Frequently the whole of a LDSC scientific endeavour is so fragmented that it may severely limit a survey.

Our experience in citation analysis thus far, indicates[19,31] that there are always a number of authors who published in local journals and although these papers were not cited according to CI's, the same authors were cited there through papers they published abroad. These authors, who are bound both to their LDSC and international publishing scene, may be called for in the first place to evaluate the LDSC-journals.

All the techniques sketched in this section (i.e. a to S) have their limitations and advantages. In what follows we describe a first attempt of correlating the simplest technique (a) used in an independent study of medical journals from Yugoslavia[25] before our general approach was formulated, with our study of the patterns of references, b, in a subset of these medical journals. A parallel citation analysis, c, was completed in the meantime[31] on a yet smaller subset of these journals, and a survey of informed opinions of over 200 medical scientists from Yugoslavia (S) about these subsets of journals is being evaluated.

3 PATTERN OF REFERENCES IN MEDICAL JOURNALS FROM YUGOSLAVIA

31 *Why Medical Journals*

According to Frame et al.[23] Yugoslavia "belongs" to the physical sciences pattern in scientific publishing - conclusion reached, perhaps, because the study was based on the ISI data-base! Milic[3], on the other hand, estimated through the Yugoslav bibliography that about half of the published papers were in medicine.

There are other reasons in favour of having chosen medical journals from a LDSC to test the coherence of the evaluation techniques discussed in the preceding Section 2.

First, there was already at hand the study of publishing modes and the physical appearance (technique a in Fig. 1) of 122 Yugoslav medical journals[25].

Second, an extensive study of ISI-biomedical literature was contained in Narin's report[20]. As a gauge for the LDSC-journals it seemed indispensible.

Third, the whole spectrum from the basic, through applied research to case studies is specific for biomedical literature. This is especially important in devising means to attribute properly the scientific label to journals in LDSC's.

32 *Choice of Journals*

In characterizing the 122 journals there were 12 parameters used by Zane[25]. They were of two kinds:

A. Editorial organization: (1) regularity in publishing; (2) ease of correspondence with the Editorial Office on bibliographic and other matters; 3) instruction to authors (4) observation of UNESCO rules; (5) uniformity of the papers; (6) subject index.

B. The form of the papers: (7) editorial professionalism; (8) abstracts (foreign languages); (9) references as required by standards, or (10) just uniform, or (11) sufficiently informative; (12) documentation sheet for each paper.

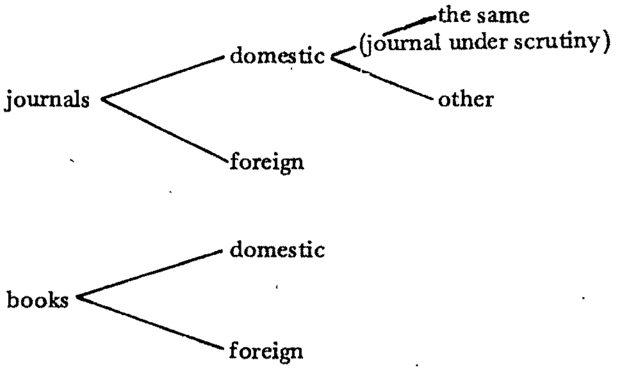
For the sake of simplicity we assigned each of the 12 parameters one point, though, obviously, neither they carry equal weight (for instance the form of the references), nor are they the optimal selection among the available parameters. An arbitrary clustering of journals according to the total points scored gave the following distribution, from which the indicated number of journals were selected for this study:

		scores				
		12-11	10-9	8-5	4-1	0
number of journals in ref.[25]	122	3	15	60	39	5
number of journals for this study	41	2	10	13	13	3

The selection for this study was justified a posteriori, because it turned out to have been sufficient to delineate definite groups of journals according to their patterns of references. The journals list is given in the Appendix.

33 Collection of Data

All the issues from one year (mainly 1978) of each journal were manually scanned and the number of references recorded from each paper, as shown below:



other (reports, theses, etc.)

For each paper with or without references the number of its page was also recorded. All the original numerical data and the basic parameters derived from it may be obtained from the author on request.

34 Reliability of Data

As the collection of data was done by non-professionals, who were given only an initial instruction, a few controls were performed: four journal titles for the same year were analysed independently by two persons. The agreement was satisfying.

These cases are marked in the graphs by "a", for journal nos.: 34, 36, 41, but 9 and 10 are also such a pair. There are several other pairs marked with "Z" for which either the same title was analysed with or without its supplement for the same year, or the next year of the same title was analysed. This was done either by the same, or another analyst. The latter pairs (marked "Z" in the graphs) thus indicate an overall spread of results owing to: (a) changes due to supplements and/or year of issue together with (b) analysts' errors.

4 RESULTS

The data on "other" publications appeared insignificant and haphazard, so that they are not dealt with here.

Fig. 2 depicts the results on the relative contribution to the volume (pages) of journals by papers without references. The abscissa means, for each journal (points on the graph), what percentage of its pages are from referenceless papers. The points bearing the journals numbers (see the Appendix) are arranged sequentially along the abscissa by ascending percentage of pages from articles without references. Along the ordinate, the number of referenceless pages in each journal are added to the previous one, i.e. the ordinate figures are cumulative. Apparently, two populations of journals are discernible, with a threshold page-percentage (abscissa) around 10%.

Fig. 3 brings together all the results bearing on the origin of references. The abscissa corresponds to percentages of references given to journals, whereas the percentages of references given to international journals are on the ordinate. Less clearly than in Fig. 2, but still discernible are two groups of journals in Fig. 3. The group of journals with similar characteristics bear the same signs (Δ ○ □) in Figs. 2, 3, 5 and 6.

Fig. 4 presents two distributions for both of which the ordinate bears the same (cumulative) number of papers. These values were obtained by summing up the papers from each journal sequentially according to the increasing number of their references given to journals. The abscissa values are expressed either as journal references per paper (left), or as percentage of all references that are given to journals (right). Of the two abscissa scales in Fig.4, the latter is equal to that in Fig. 3.

It may be noted that the normalizing unit in the last presentation was paper (article) as usually encountered in such frequency distribution studies[21, 28]. However, it has not yet been well understood what would be the normalizing unit if there is a unique one at all. We therefore expressed the same data from Fig. 4 in terms of page-unit, i.e. calculating the numbers of references (to journals) per paper's page, while cumulating on the ordinate the absolute number of the respective pages (like it was done for the case in Fig. 2). For brevity this data is not reproduced here graphically because it is similar to Fig. 4. We are aware that in the strictest sense it is the number of characters for a given language which is an absolute measure of the volume of a paper. On the other hand the paper as a whole is an information entity. It will become apparent from the next two figures that the proper choice of the normalizing unit is not a trivial matter at least for the purpose of the present study. Until further data come along we chose to take both representations into account.

Figs. 5 and 6 bring out the interdependence of the number of reference to journals (per page in Fig.5 – per page in Fig.6) with the percentage of references to journals (identical abscissa-scale in Fig.5 and 6).

5 DISCUSSION

51 *The Lower Cut-off: the Least Scientific Journals*

It was pointed out here that the first (and most important) step in sorting out LDSC-journals with respect to their scientific merit is to delineate those which are most certainly least scientific.

We therefore turn our attention first to Figs. 2 and 3. Lack of any references in a paper was taken as the absolute indicator of a non-scientific article or journal as viewed by Windsor and Windsor[28]. Price[21] was more stringent by regarding as non-scientific even those journals that had less than ten references per paper. If we combine both approaches, and consider also Figs. 5 and 6, then, clearly, a group of 12 journals (marked Δ) from our sample belong to the least scientific groups, because:

(1) nine of them (75%) have more than 10% (and up to 49%) of their pages from papers without any reference at all (see Fig. 2);

(2) at least nine of them have given less than 75% (and down to 50%) of their references to international journals in distinction to the bulk of the rest of journals (see Fig.3);

(3) all 12 journals are clearly separated into a homogeneous group with less than 55% references to journals and less than 0.7 references to journals per page (Fig. 6) or, less clearly, with less than 10 references per paper (Fig. 5) of which ten journals (83%) have been less than 5 references per paper;

(4) The mean score according to Zane's analysis[25] (a in Fig. 1) is 2.5 ± 0.7 indicating thus also a low level of editorial and publishing practices for these 12 journals.

52 *The More Scientific Journals*

Whereas the least-scientific journals were well separated from others, but more condensed within the boundaries in Fig. 6 than in Fig. 5, the two groups of the more scientific ones (marked ○ nad □) are arbitrarily delineated in both of these figures. Additional data (other journals and also the references' age distribution) would be required to sharpen the presently fuzzy boundaries, which were set, however, considering both diagrams simultaneously and the distribution curves (Fig. 4).

The "middle" group (marked ○) contains namely most of the journals forming the steepest part in the distribution graphs, like in Fig. 4 and in that for the page-normalized data not presented here. It therefore means that the middle group (marked ○) comprises journals with the dominating pattern of references, i.e.

a preponderate number of pages (papers) from the whole sample (see Fig. 4) is contained in this group of journals. However, along the steepest part of the distribution curve in Fig.4, there are also a few journals from the upper-extreme journal-group (☐ in Figs. 5 and 6) together with all those from the uppermost tail of the distribution curves.

This upper-extreme group of 15 journals in Fig. 5(☐) could be defined as having more than 8.5 references to journals per paper and more than 70% of all references to journals. The latter is the same, of course, for Fig.6, but the other condition is set at more than one reference to journals per page.

It could not be stressed enough that at this stage of the study most that we can hope for is discern some "pattern of behaviour" for groups of journals, whereas final ranking of individual journals as to their scientific merit must await also the results from the c and S technique (Fig. 1). Notwithstanding this, there are some correlations (interdependences) worthwhile to be discussed in the next section.

53 General Patterns

- parameter correlations

For both the ordinate parameters in Figs. 5 and 6, namely the number of references to journal per paper and per page, respectively, there is a highly significant (the F-ratio significance level = .0000) linear interdependence with their common (abscissa) parameter, the percentage of (all) references given to journals.

It means that those authors from Yugoslav medical journals who choose to quote less references to books (and "other") refer also to a greater number of papers from the journals. We are not aware of this finding in the bibliometric literature and cannot therefore generalize, but the interdependence in the present case is so strong that it would be surprising if it were not a widesread attitude of authors. However, we do not see any a priori reason why different authors quoting to a varying degree books, could not quote equal (similar) number of journal references per paper (or per page)? Has this anything to do with the (bio) medical field, or LDSC, or is it a more general habit? If so, it would be interesting to find out what is its basis, if any, in the scientific methodology.

- a - to b - technique correlation

We have set out to see if the simplest and most objective, but least relevant technique a (Fig.1) of characterizing the journals by their editorial and physical features could be "promoted" to a better relevance standing. To the extent that the pattern of references in a journal (technique b in Fig. 1) is indicative of the scientific merit as suggested in the literature (and, in this study, at least with regard to the lower cut-off) one would expect certain correlation between a and b. This is illustrated in Fig. 7. Along the abscissa are values of the scores by journals from our sample in the a - study of Zane[25]. The ordinate bears the numbers on references (to journals) per page and per paper. The drawn rectangulars depict the standard errors (uncertainties) for the points calculated as means for the three groups of journals in Figs. 5 and 6 with their respective symbols.

The values for abscissa were calculated for each of the three groups of journals from our sample using the original data[25]. The differences between pairs of values in both coordinate directions are significant (by Student-test) at a level of < 0.001.

The linear relationship is evident, which is gratifying on two accounts:

- the twelve parameters chosen by Zane[25] obviously incorporated sufficient indication of "scientific climates" within which the journal originated;
- unless further development (including the distribution of references' age) show that the pattern of references determination (b in Fig.1) is superior for individual journal ranking to characterization by editorial and physical features (a in Fig. 1) the former may be replaced by the latter (for journals grouping), which is by far simpler, cheaper and faster.

Five journals from our sample may be regarded as two-way comunication channels for scientific information : Acta Pharmaceutica Jugoslavica (see ref.[19]), Acta medica Iugoslavica and Arhiv za higijenu rada i toksikologiju (according to our research by c[31]; Zdravstveni vestnik, and Periodicum biologorum which have been in the ISI-selection a number of years. The first four are in the "uppermost-tail" group here, whereas the fifth is in the (middle) "volume-dominant" group.

- Comparison with international science

In this section we shall briefly compare some of the gross figures obtained here (a case of LDSC) with those from the international science, the latter, in fact, being represented by Citation Indexes.

Price[27] found from the data-base of Science Citation Index that "on the average there are about 14 references from each of the source items". He explained this figure by postulating that "it is the old papers that are throwing off citations every year ...so that... the average number of references in a paper is determined by the size of the available archive of literature in that field... the number of references per paper must be a small constant (less than one) plus the natural logarithm of the size of the archive. The natural logarithm of one million is about 14 and that is why the number of references is what it is".

This lengthy quotation was necessary in order to get our figures in a right perspective. Namely, even if there is only a one-way stream of scientific information (intern.sci. LDSC), LDSC's ought to conform to the above Price's bibliometric "law" as close as the (LDSC-) research is close to the world's science.

Now, all our Figures refer to number of references to journals. In order to compare our data with that of Price's and other (see later), we calculated the number of all references per paper for each of the three delineated groups:

least scientific :	11.4 ± 1.3
volume-dominant :	14.8 ± 1.7
uppermost tail :	16.6 ± 1.0

These lump-values indicate that our sample of medical literature from a LDSC is tapping off the world's scientific pool reasonably well, expect for the group credited with least scientific attributes. The "uppermost tail" is actually above the Price's grand mean.

On the other hand Narin[20] states that "the field of biomedical research has substantially higher references... between 18 and 20 per publication". In his study Narin classified all the (SCI) biomedical literature studied (over 900 journals) into four research levels. Using his data we derived the mean number of all references per paper for each of the four research levels:

L_1 = Clinical observations : (like JAMA)	10.8 ± 0.4
L_2 = Clinical mix : (like New. Engl. J. Med.)	14.4 ± 0.4
L_3 = Clinical investigation : (like J. Clin. Invest.)	15.4 ± 0.4
L_4 = Fundamental research : (like J. Biol. Chem.)	15.6 ± 0.4

The smaller standard errors here as compared to ours are due to 10-20 times larger number of journals in each of Narin's groups. The means, however, do not corroborate the above statement of Narin's about exceptionally high referencing in biomedical literature. As to the four research-level groups, only the "clinical observations" differ signficantly ($P < 0.001$) from all the other groups which among themselves are rather alike.

Compared to the three groups delineated in the present study, L_1 is similar to the "least scientific" one, whereas the "uppermost-tail"- and the middle-group are in agreement with L_4 (i.e. L_2 and L_3). However, further study is necessary to establish whether the "least scientific" group of journals here could be regarded as "clinical observations". From an examination of these journals, and the fact that group is, according to our methodology, much more profoundly separated from the other two than is L_1 from L_2, L_3, L_4, it seems that these "least scientific" journals are in fact kind of educational, instructional and general-information publications.

6 CONCLUDING OVERVIEW : THE NEW, THE SURPRISING, AND THE GENERALIZABLE

Whereas earlier bibliometric studies tended to derive from the references some gross characteristics for various subject fields, i.e. for their representative journals, we have shown here that the pattern of references may be used to delineate thresholds for what is most likely the scientific merit within a given subject field (here : medical). In this respect, the degree of "referencelessness" (percentage of pages from articles without references at all) and "journal referencing" (percentage of references to journals), with the "referencing intensity" (i.e. number of references per paper or per page) yield distinct boundary conditions for non-scientific journals. Surprisingly, the boundary is much better defined when the "referencing intensity" is normalized per page.

The remaining subset of the medical journals could be divided into two groups in a less clear-cut manner, by taking into consideration the degree of "journal referencing" and the "referencing intensity", the latter being here a more distinctive attribute if expressed per paper.

Although we did look for it, the linear correlation found between the three journal groups delineated in this study of the referencing pattern with their respective publishing-editorial mean scores is surprisingly convincing.

Hence, there are quite objective means to evaluate the scientific merit of journals published in less developed scientific communities (LDSC). The above finding that the physical form of a journal does reflect its scientific merit may indicate that the journals under scrutiny are from a LDSC in which the overall formal editorial performance has not yet come to equilibrium with standards from more developed scientific communities. One can imagine even such a state of affairs in which a higher publishing-editorial standard may just hide the less satisfactory scientific content. If studies as this one, or sponsors' pressures as to the form only, result eventually in such a "discord", it could be attributed to the "true" uncertainty principle inasmuch as the observer ('s method) perturbs the system. Though, a promising research may be to see how widespread is the observed "form-content" correlation for different LDSC's.

To generalize on the basis of the present data would be premature both with respect to subject fields and to different LDSC's. However, it appears highly probable that the non-scientific journals may be identified with certainty, without resort to citation analysis and/or experts' opinion. On the other hand, the ranking of those journals that remain as probably scientific will require such additional evaluative means.

Finally, whereas the lowest threshold for scientific merit of LDSC-journals has been determined without resort to any of the existing journals selections (points 1-5 in Fig. 1), i.e. using only research-analytical methods (points a and b in Fig. 1), the latter must await results of further studies (point c and S in Fig. 1) in order to see whether these simpler methods (a and b) could yield alone the upper threshold in identifying the scientifically most valuable journals from a LDSC (be it country, region or - a subject field!).

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APPENDIX

The List of Journals Studied

[nos. as in the figures, title, place of publishing, year (+ suppl.)]

1. ACTA BIOLOGIAE ET MEDICINAE
Pristina, 1978.

2. ACTA CHIRURGICA IUGOSLAVICA
Skopje, 1978.

3. ACTA MEDICA IUGOSLAVICA
Zagreb, 1978.

4. ACTA PARASITOLOGICA IUGOSLAVICA
Zagreb, 1978.

5. ACTA PHARMACEUTICA IUGOSLAVICA
Zagreb, 1978.

6. ACTA STOMATOLOGICA CROATICA
Zagreb, 1979.

7. ALCHOLISM
Zagreb, 1978.

8. ARHIV ZA HIGIJENU RADA I TOKSIKOLOGIJU
Zagreb, 1978.

9. ARHIV ZA ZASTITU MAJKE I DJETETA
Zagreb, 1978.

10. ARHIV ZA ZASTITU MAJKE I DJETETA
Zagreb, 1978.

11. BIOLOSKI VESTNIK
Ljubljana, 1978.

12. DEFEKTOLOGIJA
Zagreb, 1978.

13. DIABETOLOGIA CROATICA
Zagreb, 1978.

13/Z DIABETOLOGIA CROATICA
Zagreb, 1978, (Suppl. 1, 2)

14. FARMACEUTSKI GLASNIK
Zagreb, 1979.

15 FOLIA ANATOMICA IUGOSLAVICA
Sarajevo, 1978.

16. JUGOSLAVENSKA GINEKOLOGIJA I OPSTETRICIJA
Skopje, 1978.

17. JUGOSLAVENSKA PEDIJATRIJA
Zagreb, 1977.

18. KINEZIOLOGIJA
Zagreb, 1977.

19. LIJECNICKI VJESNIK
Zagreb, 1978.

20. MAKEDONSKI MEDICINSKI PREGLED
Skopje, 1978.

21. MEDICINA
Rijeka, 1978.

21/Z MEDICINA
Rijeka, 1978, (Suppl. 1, 2)

22. MEDICINAR
Zagreb, 1975.

23. MEDICINSKA ISTRAZIVANJA
Beograd, 1979.

23/Z MEDICINSKA ISTRAZIVANJA
Beograd, 1979, (Suppl. 1, 2)

24. MEDICINSKI PODMLADAK
Beograd, 1976.

25. MEDICINSKI PREGLEDI
Ljubljana, 1978.

26. MEDICINSKI VJESNIK
Osijek, 1977.

27. MEDICINSKI ZAPISI
Titograd, 1977.

28. PERIODICUM BIOLOGORUM
Zagreb, 1978.

29. PRAXIS MEDICI
Zagreb, 1978.

30. PSIHOTERAPIJA
Zagreb, 1978.

31. RADIOLOGIA IUGOSLAVICA
Ljubljana, 1978.

31/Z RADIOLOGIA IUGOSLAVICA
Lubljana, 1977 (+ Suppl. II)

32. RADOVI MEDICINSKOG FAKULTETA U ZAGREBU
Zagreb, 1976.

33. SOCIJALNA MEDICINA
Sarajevo, 1978.

34. SOCIJALNA PSIHIJATRIJA
Zagreb, 1978.

35. SRPSKI ARHIV ZA CELOKUPNO LEKARSTVO
Beograd, 1975.

36. SYMPOSIA OTORHINOLARYNGOLOGICA IUGOSLAVICA
Zagreb, 1978.

37. SPORTNOMEDICINSKE OBJAVE
Ljubljana, 1979.

38. VJESNIK MEDICINSKIH SESTARA PRIMALJSKOG SMJERA SRH
Zagreb, 1979.

39. VJESNIK RADIOLOSKIH TEHNICARA
Zagreb, 1978.

40. VOJNOSANITETSKI PREGLED
Beograd, 1978

41. ZDRAVSTVENI VESTNIK
Ljubljana, 1978, (+ Suppl. I)

42. ZDRAVSTVO
Zagreb, 1978.

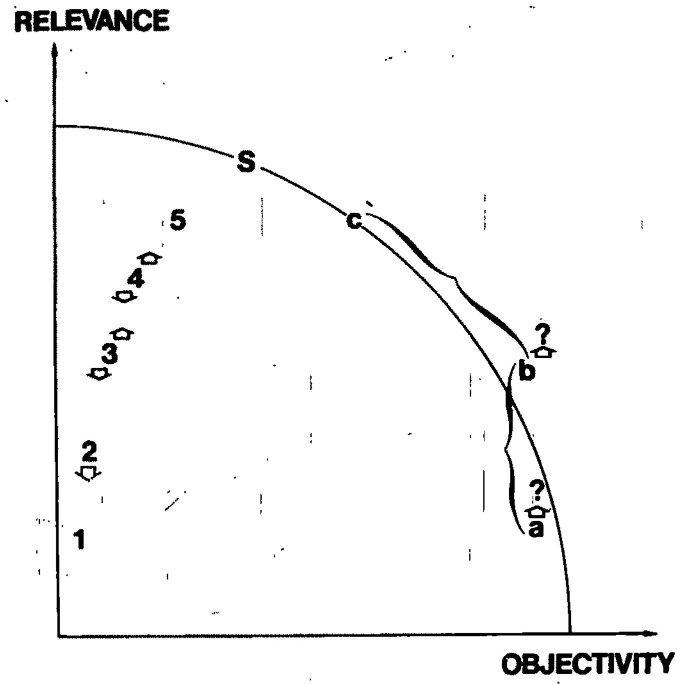

Fig.1. The "uncertainty graph" (after ref.[13]) relating quite qualitatively the objectivity (abscissa) of various methods to their relevance in evaluating scientific merit of journals (ordinate). Points 1-5 : various existing selections, generally based on (partly) undefined methods by - sponsoring agencies (1) domestic bibliographies, (2) and abstracting services, (3) international abstracting or bibliographic services, (4) and citation indexes, (5) Points a - S : research-analytical methods - editorial and publishing modes reflecting the "scientific climate" of a journal (a) the pattern of references, (b) citation analysis, (c) and informed opinions of scientists (S).

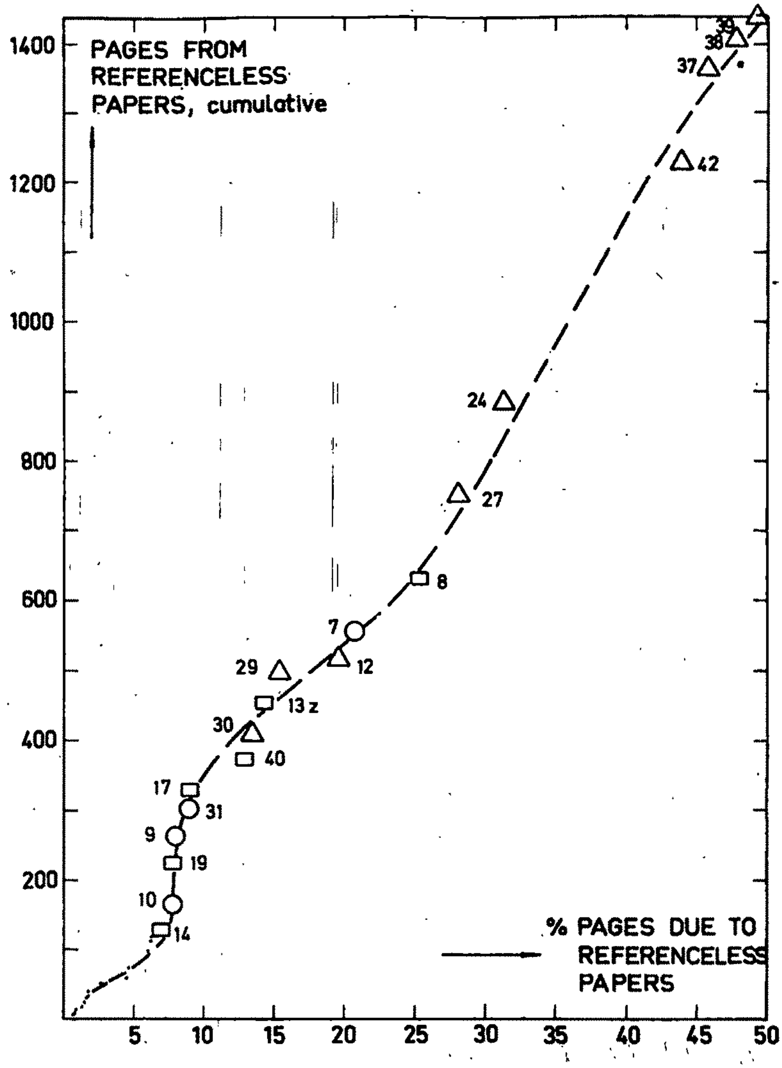

Fig. 2. Distribution of journals with referenceless papers, by the percentage of their pages out of all the pages from articles in journal (abscissa) and the total number of the referenceless pages (cumulative, ordinate). The dots (without symbols) refer to the journal titles (see Appendix) in ascending order (towards No. 14), as follows: 35, 23, 41, 20, 26, 34a, 41a, 21, 13, 16, 52, 21Z. (For the symbols see Fig. 5).

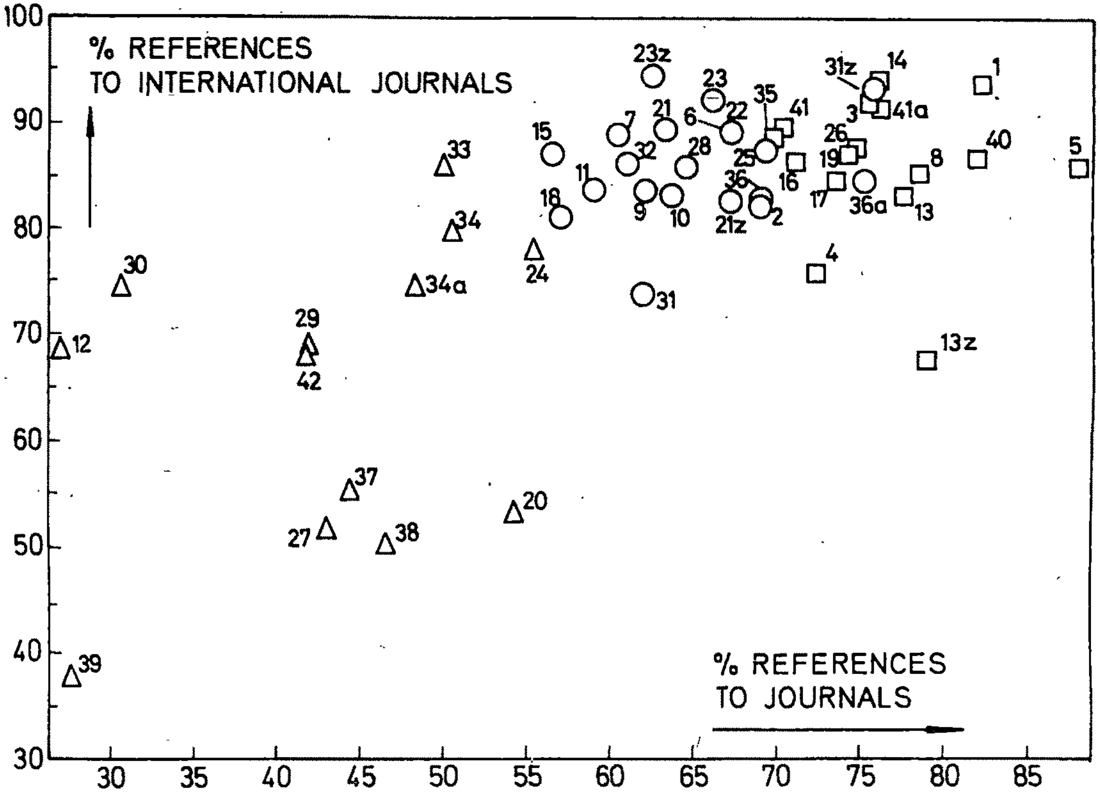

Fig. 3. Relationship between percentage of (all) references to journals (abscissa) and percentage of references to international journals (ordinate). (See Appendix for journal titles according to the members, and Figs. 5 and 6 for explanation of symbols).

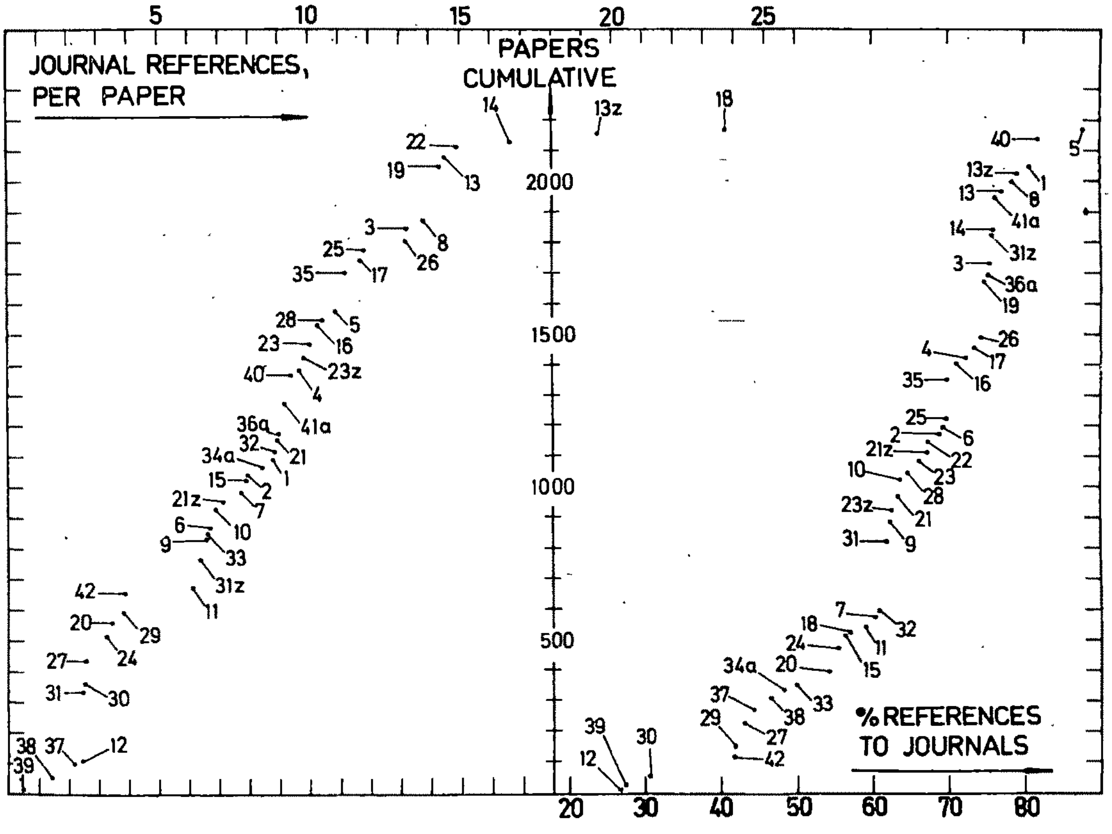

Fig. 4. Cumulative distribution of papers from journals (ordinate) according to the ascending number of references to journals per paper (left) and the percentage of such references (right). (The numbering of the points refers to the journal list in the Appendix).

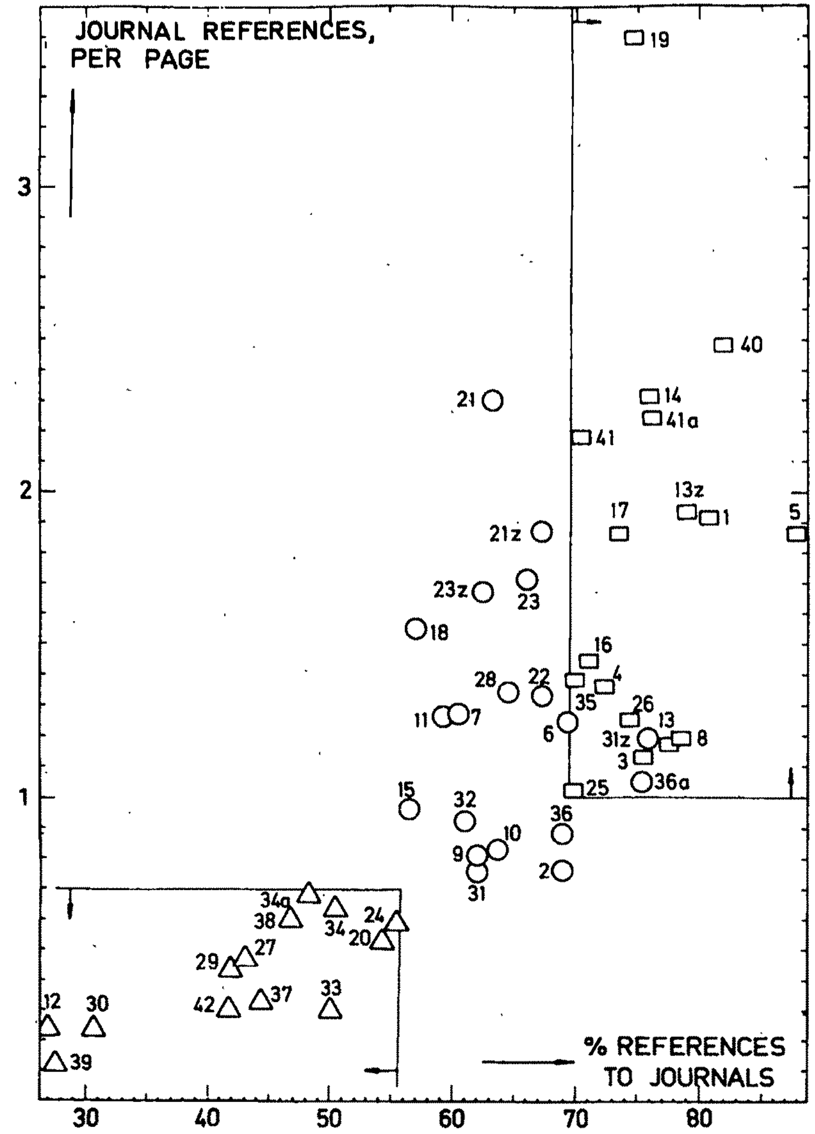

Fig. 5. Interrelationship between the percentage of references (of all) to journals (abscissa) and the number of them per paper (ordinate). The number of the points refers to the journals list in the Appendix, whereas the three different signs indicate the three compartments separated by the border-lines drawn as described in the text : Δ-least scientific journals; ○-volume dominant one; □-uppermost-tail group.

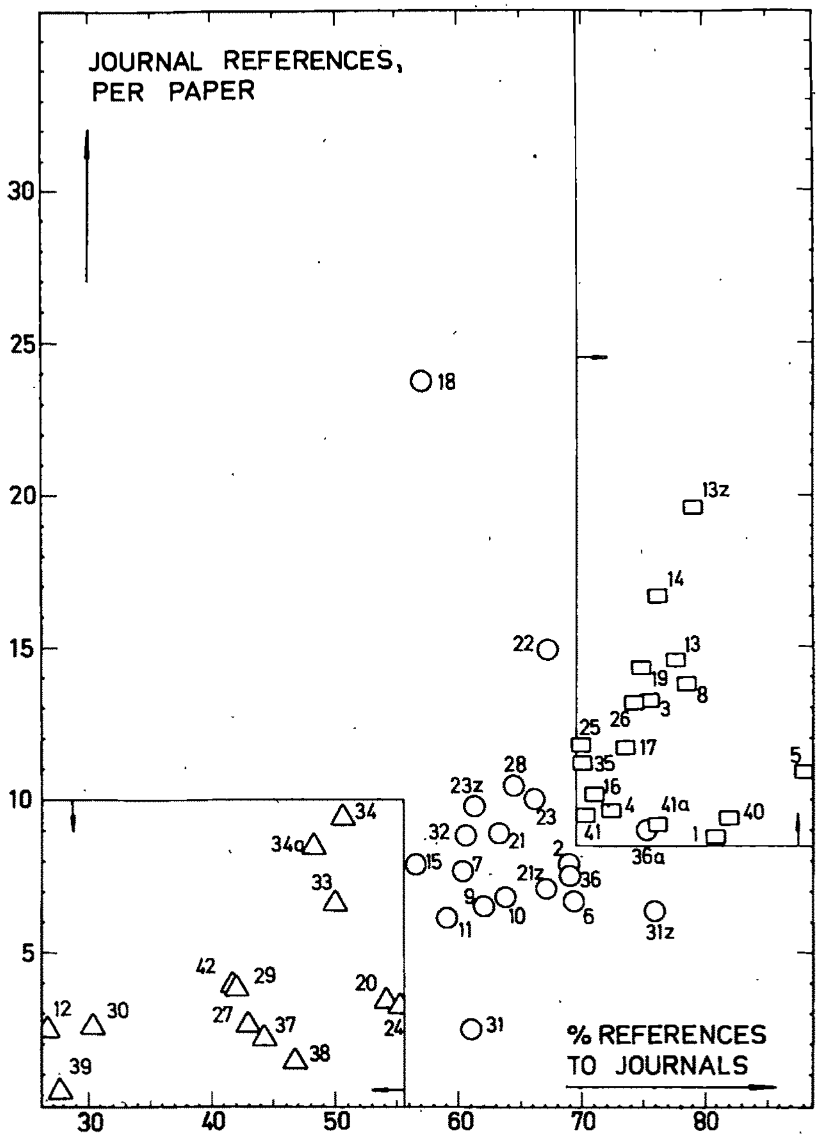

Fig.6. Interrelationship between the percentage of references (out of all) to journals (abscissa) and the number of them per page (ordinate). The numbering and the signs are as in Fig.5.

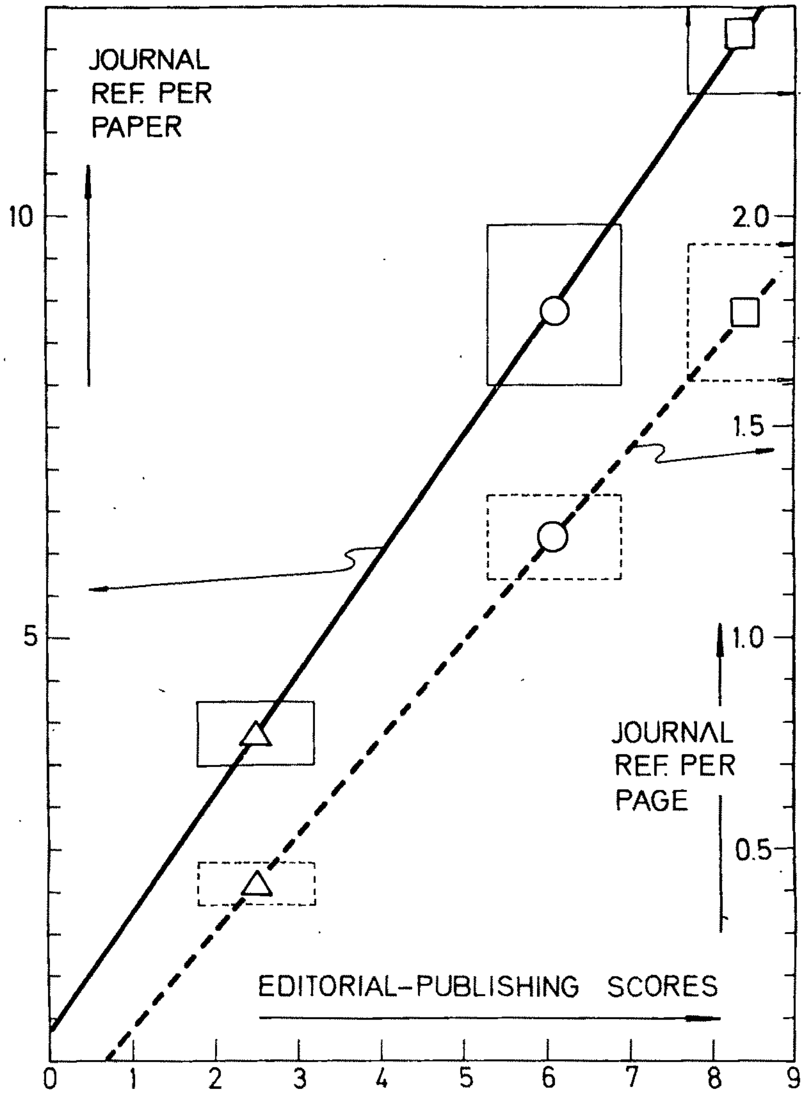

Fig. 7. Correlation of the editorial-publishing scores of journals (abscissa, calculated according to ref.[25]) with both the number of journal references per paper (left ordinate - full straight line) and journal references per page (right ordinate - dashed straight line). The ordinates calculated as means ± S.E. from the three groups of journals in Figs. 5 and 6 using the same symbols.

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INFORMATION BROKERS

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Introduces the concept of an information broker. Describes the factors responsible for emergence of information brokers namely nature of clients served, mode of getting requests, resources, and marketing techniques used. Provides an overview of services offered by information brokers. Finally, discusses the nature of information brokers industry with special reference to India.

1 INTRODUCTION

The concept of information as a salable commodity is increasingly being recognized and accepted in our present society which is entering in the new information age. As a result, we find that producers of information especially those who can deliver it in machine readable form, those who can facilitate the distribution of information by providing telecommunication facilities and software, and finally those who are able to repackage information economically and quickly in a form wanted by the user can expect increase in demand and growth in their activities. The present paper is an attempt to provide a bird's eyeview of the last category of services generally involved in the repackaging of information. This sector of information industry has experienced a considerable growth over the last five to seven years.

These services or their agents are called by different names [1] as listed in Table 1.

Table 1

Information Broker
Information Consultant
Information Specialist
Information Retailor
Information Service
Library Consultant
Library Research Service
Management Consultant
Consulting Information Specialist
Information Consultancies

The most popular name being the information broker. An information broker is normally an individual who on demand seeks to answer questions using all sources available or one can say a friendly expert who prepares a package of information for a fee in response to needs and demand of information clients. He acts as a clearing house linking sources with those who need it. Based on the above understanding, we can all this type of service as fee-based information services.

Over the last few years a large number of fee-based information services have emerged in a number of countries, the United States taking a lead. They are providing services to researchers, policy-makers and planners who are acutely aware of the need of information and complexity of obtaining it. Their clients range in size from multimillion dollar conglomerate to one man outfits. They are located in business, industry, government and social service and come from various professional shades namely engineers, accountants, lawyers, artists, system analysts, biologists, architects, authors, etc.

The main area of specialization in providing these services is basically in the skill of getting information in all fields of knowledge; a few broker's specialize in particular subject fields. These services answer question of any size, ranging from a 5 minute request for some specific statistics to a request for a major market study involving many days of work. The information broker offers a combination of following services namely data base searching, document delivery, information research and analysis,information management, etc. Most of these services are emerging in the private sector, but some large academic and public libraries have also set up separate fee-based service departments for requests that cannot be met due to the time and budget constraints.

2. WHY FEE–BASED INFORMATION SERVICES ?

The fee-based information services have emerged in different countries because of a number of factors. The first major factor has been the complexities introduced as a result of literature growth and explosion [2]. This has led to increase in specialization and consequent fragmentation and dispersion of literature. As a consequence, many relevant papers in a field are often found to be dispersed in a large number of journals making it difficult for the users to locate them. With the growth of literature, a number of secondary services have come up for the bibliographical control of literature in various subjects. For an effective utilization of these services, it is necessary to know about structural developments taking place in them from time to time, knowledge of indexing systems, collective use of indexes, and availability of cumulative indexes [3], etc. The users, very often, are not able to keep track of the above developments. Also, search on a particular topic is very time consuming and require lot of patience.With the fast technological developments taking place in the area of microelectronics, computers, and telecommunication industry vast amount of printed information available in secondary services have started becoming available in machine-readable from (magnetic tapes and discs) popularly known as data bases. In 1975, as many as 301 such data bases were available and the number has increased to 528 in 1978. These data bases are increasingly becoming available on-line. In 1978 alone there were 2.67 million on-line searches [4]. Despite all the optimism regarding their use, there is considerable amount of variation that one finds in these data bases. Data bases vary with respect to context, subject covered, format, chronological coverage, relationship that may exist between them, and the way they are loaded in the system. They also vary with respect to features and functions, vocabularies, systems used for searching them, access protocols, command languages, systems responses and messages, system features and even data element labels or tags. There are also problems regarding retrieval steps, multiplicity of names and problems of subject access in data bases. As a result of the variety of data bases and complexities involved and time and skill required in searching them the need for intermediaries (fee-based information services) has became inevitable [5].

The second contributing factor has been the deficiencies that exist in the present organizational set-up of library and information centres. Most of them decline to undertake time-consuming literature searches, bibliographical compilations, report writing, translation services and other tasks for which they are not adequately staffed or facilities not provided. Also, most of them remain within their four walls to answer their client's questions, which is a big handicap for them [4].

The third factor, which is most important, is the special characteristics of the fee-based information service which distinguish them from the available library and information services. Their general approach is on information needs of users rather than books-and-journal orientation. The information is collected by them wherever it is available and a large number of these services are effectively using marketing and promotional techniques to achieve their objectives. They also satisfy the clients on a cost effective basis and present information in a manner that reflects the attitude of prospective clients. In these services information is taken one step further by analysing, interpreting, and presenting it in monographs, reports and other studies that are custom tailored to the client's specific needs. Most of the users also find it convenient and most-effective to turn to them for answering their needs. The majority of these services have considerable library and information science experience, and are aggresive, have business-like patience, are well informed about sources, have sense of humour, and financially able to weather a slow start [6].

3 SOME FEATURES OF FEE–BASED INFORMATION SERVICES

3.1 Resources

The fee based information services use all possible resources that are relevant and accessible to answer their clients' requests. They include: building up of an in-house collection, rental a computer terminal, make arrangement with data-bases through vendors' use, investment in training of staff for undertaking specialized searches, use of nearby libraries and a panel of experts, purchase of back-up facilities like photocopying machines and extensive communication facilities [7,8]. Very few services can afford to maintain extensive internal collections. The collection of these services normally includes reference works, company files, and information supplied to the clients in the past. Normally the emphasis is on that type of literature which, in their opinion, is irreplaceable or cannot be obtained easily from the standard sources. Most of the fee-based information services have installed computer terminals and maintain links with several data-bases through their vendors by paying subscriptions or minimum fees required by them. Several of these services also frequently use libraries in the nearby towns or cities. In order to avail of such facilities, majority of services find it appropriate to locate themselves in those areas where extensive network of specialized libraries exists. Also many of these have extensive communication facilities like telephone, telex, etc. The larger services can also afford special services like the "Wide Area Telecommunication Service (WATS) " for low cost, high volume, long distance services from American Telephone (AT&T). Many of these fee-based information services maintain a panel of consultants. Normally the larger and medium-size services utilize these facilities. Experts mainly enable the information services to gain current data where there might be on-going research or unpublished material. A few services specialize only in document procurement and maintain extensive photocopying facilities to serve their clients faster and in time.

3.2 Marketing Techniques

Marketing techniques are effectively being used by most of the present fee-based information services. There are several marketing techniques and tools which are normally used. The most important ones are: promotional techniques such as direct mail, yellow pages and telephone listing, advertisements and promotional brochures. These are being supplemented by techniques which determine market needs and requirements of clients [9]. It is not just enough to have a properly designed information product or service; it must be presented in such a manner so that it should reflect the attitude of prospective clients. At present, only a few libraries undertake market research, in the form of public opinion sample and that too, on a broad state or community basis. That is why the use of marketing techniques is an important area of advantage of fee-based information services over traditional library and information services.

A high percentage of fee-based information services has listings in telephone directories in contrast to a small percentage which takes out advertisements in yellow page listings. These services normally appear in yellow page listings under the following headings: Library Research Service; Library Research and Service; Market Research and Analysis; Information Bureaus; Information Services and Bureaus, etc. The least popular amongst the promotional channels seems to be advertisements in radio and television. Most of the advertisements in these medium appear either in commercials or radio spot programmes. Fairly large number of fee-based information services take out advertisements in professional journals, but only a few concentrate in library and information science journals. Also, a substantial number of them take out advertisements in local newspapers. Only a few can afford to place their advertise-

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ments in national dailies. Some of the ways normally used in newspaper dailies are establishing columns like "What do you want to know – Activities of Individual Services", etc. Preparation of promotional literature (pamphlets, leaflets, etc.) is the most popular and widely used methods by fee-based information services. This type of literature is attractively designed, normally listing their services with their plus points, and sent to those individuals and organisations which are considered as their potential clients. The most widely and highly effective marketing technique is rated as the Word-of-Mouth. Other techniques normally used are: demonstration at exhibitions, conferences, professional meeting of their services, producing in-house newsletters, sales cells, etc.

3.3 Mode of Getting Requests

Requests are received by fee-based services from clients either in person or through telephone, telex and teletype methods. A major percentage of these requests comes through telephones and mail. In-person requests are not common except for non-profit sector based fee-based services. Similarly telex and teletype methods are rarely used.

3.4 Nature of Clients

A large variety of clients are served by fee-based information services. the nature of clients vary sharply with respect to the size of fee-based service serving them [10]. For the large fee-based information services, clients are mainly spread all over the country and abroad too. Larger corporations are their prime clients. Within the corporations, marketing departments are the clients most often served. R&D departments are second in importance, top administrators account for a small number of requests. In case of medium-sized fee-based services, clients are mainly located in larger metropolitan areas. Among their potential clients, larger corporations contribute (20-50%), small business (20-60%), government (20-50%) and non-profit (5-15%) to their business. Clients primarily come from R&D and marketing groups. Finally in the case of small fee-based information services, clients normally are restricted to the local area or region of their location. About sixty per cent of their clients is from R&D and marketing groups. The rest of their clients comes from administration, production, etc.

4. SERVICES

The fee-based information services offer a variety of library and information services ranging from simple document delivery, compilation of bibliographies, indexing, current awareness & SDI services to on-line searching, preparation of analytical reports, market studies, research, consultancy, etc. Some of the activities of these fee-based information services are described below.

4.1 Document Procurement

Document Procurement is one of the most widely practised activities of the fee-based information services. Document Procuremt requests are generated in many ways by these services.

i) Many times, these firms get direct requests from users for a specific document.

ii) Often, users request for a literature search on a particular problem or a research project, etc. As a result, lists of citations are being identified. Out of such lists these services often get requests for procurement of serial articles and other documents.

iii) Some services are offering current awareness and SDI services to their clients. The users identify from time to time the relevant material which they will like to have regularly from these services.

iv) Many services from time to time prepare specialised bibliographies of their own in certain specific areas keeping their clients' interests in view. These bibliographies are sent to clients either free or against some nominal payments. The clients select material from these bibliographies and normally order for some material important to them.

Recruitment of field staff and inter-library methods are normally used by these services to gather photocopy of requested material. These services also maintain reciprocal arrangements with special libraries which allow a faster and reliable processing of requests. User charges are sometimes levied by libraries on them.These information services also pay annual fees to some academic and corporate libraries. In many cases several of the information services or their employees become members of library associations. As a result reciprocal arrangements are granted to these services through such memberships. These services also extensively maintain publishers' files and good contacts with government agencies and book dealers which save their time and efforts in obtaining unusual, out-of print and unpublished items. Many information services specialise in document delivery and they count their volume of requests in hundreds per month; others provides service as a convenience to their customers. Many services are also participating in the newly introduced on-line electronic systems namely: Lockhead "DIALORDER" service, SDC's "Electronic Maildrop" and Telecommunication Corporation of America's "The Source" service, which enable the user to communicate directly with the document suppliers. Requests are handled faster through these electronic mail systems than through regular mail. The increasing popularity and rapidly lowering costs of this technology is expected to revolutionalize document delivery services within next few years. One of the leaders in providing document delivery service is "Information-on-Demand" (IOD) located in Berkeley which processes about 8000 requests per month. Other important services which specialise in this area are: Information Specialists, Cleveland, Ohio; Info-Search (Mich.), FIND/SVP (N.Y.), Data Quest International, Inc (Chicago.), etc. [11,12].

Photocopying prices for these services range normally between $ 0.5 to $ 0.40 per page. Another $ 1.0 might be added for mailing. Document delivery prices may range from $ 5.25 to $ 7.50 per article or higher plus photocopying and royalty charges. Rush service might add $ 2.50 to $ 10 more. There will continue to be great short-term demand for document delivery service, especially directed to small firms. A large number of requests to these services have come from clients that have the ability to locate the information but find it most cost-effective to turn to an organisation or an individual who can perform the work at a lower cost. It is expected that this type of service will not have a bright future both in terms of the volume of demand and in terms of profitability.

4.2 *On-Line Searching*

Several fee-based information services are offering on-line services through a variety of machine readable data-bases. On-line searching seems to be a prominent area of activity of more than fifty percent of such services in United States. Compared with United States, on-line searching has a secondary role in other countries because of high telecommunication costs. Using a computer terminal, relevant citations to current as well as retrospective literature on topics of interest in fields covered by machine readable data-bases can be supplied to customers through on-line searching. As of today, the three major on-line data vendors, namely Bibliographical Retrieval Service (BRS), Lockhead and SDC provides access to over 130 data-bases containing information in all fields of science, technology, law, medicine, humanities, [13] etc.

While there is a significant overlap between vendors, analysis shows that a significant number of files are unique to each as shown in Table 2.

Table 2

Number of Data-Bases available with the Three Leading Vendors

	Lockhead	SDC	BRS
Total Numbers of Files Offered by Vendors	93	59	27
Files Uniquely Available from Vendors	51	37	7

Source: Directory of On-Line Information Services. Rockville, M.D., CSG Press. September 1979.

Fee-based information services usually maintain access to more than one of the three large vendors as well as other suppliers of specialised data-bases. They frequently make arrangements with vendors by paying regular subscriptions or minimal fees as the case may be. Searches at the fee-based information services have been carried out by staff who have extensive on-line experience and keep abreast of constantly changing software capabilities developed by major vendors. In addition, they undergo from time to time special training necessary for access and for intraction with these data-bases.

The on-line searching has many advantages. For quick results citations can be displayed in various formats right at the terminal. If one prefers, search results can be printed on a 8½"x 12" paper suitable for filling. Each citation contains a full reference to the printed document (author, title, publication, source, data, etc.). At present creating a suitable infrastructure for undertaking on-line search on a particular data-base is not very costly in the United States. A terminal suitable for searching for a Lockhead System, for example, costs approximately $ 2200. This is the largest capital cost that most of the smaller fee-based information services have. A typical on-line search cost a user in terms of:

i)	Data base Access Charge (Including Payment of Royalties)	$25–$150	Per hour
ii)	Prices for Access and Printing Off-line Citations	$0.5–$0.50	Per citation
iii)	Cost of communicitation	$5–$10	Per hour for a Tymshar & Talent Network
iv)	Cost of Providing Services by the Firms		

On the basis of above estimate, a typical ten-minute search of most frequently used data bases costs approximately $7 to $8 in United States.

The future of on-line searching does not look very bright and is increasingly being dependent and affected by the developments in new technologies. With the rapid innovations taking place in the area of micro-electronics, computer and communication technologies, one finds that low cost terminals and printers have become widely available in the market, search strategies have been simplified, and cost of communication has been reduced considerably. As a result, the cost of providing on-line search has become considerably low. There is an increasing possibility that a large number of users will start installing their own on-line searching terminals in future. Many firms specialize in this area. Some of the important ones are: Cibbarelli Associates Computerized Literature Searching Service, Univ. of California, Documentation Associates, Info-Mart, Richard L.King, etc.

4.3 *Information Research and Analysis*

The purview of information research can range from simple reference question to a preparation of a full report on a specific topic. In order to make full use of data retrieved through on-line searching, many clients ask their information brokers to also sift, analyse the search yield and eliminate duplicate entries out of citations retrieved as a result of interaction with different data-bases, and arrange the material in a logical subject clusters and provide indexes. The differences between a full report and a raw computer-output are a worth of great deal to busy clients[14]. Other searches may be supplemented by further library research and statistical analyses of retrieved data. Surveys, state-of-art reports and analytical based on specific custom information needs are also prepared frequently by information brokers. Some of the brokers which specialize in the area are: Diversified Finders; Information-on-Demand; Information Resources; Arthur D. Little, Inc., etc.

4.4 *Information Consultancy*

Many organizations are beset with information problems and need consultancy services to arrange and organize their files and data. Many brokers provide services in this area, which range from design of library and information systems to the design of library and information networks. Service under the category of design of library and information system includes advice on space planning, furniture design and type; manpower planning and assessment; information services; assessment of information needs, etc. Some of the important firms in this area are: Taylor and Associates, Information Professionals, Information Consultants, Information &

Research International, etc.

The Second important area of consultancy work in the library and information network is designing. Among the larger brokers firms well known are: Boeing (Seatle); Peat, Marwick and Mitchell (New York); Nelson Associates Inc. (Cambridge, M.A.). Boeing has mainly been associated with "Washington Library Network" and Network Design for North Bay Co-operative (a group of California libraries). Peat, Marwick and Mitchell (New York) did a significant study for and associated also with California State Library Network. Nelson Associates, Inc. (Washington, D.C.) have been actively associated with the New York State Inter-Library Loan (NYSILL) Program. Arthur D. Little, Inc. (Cambridge, Ma) have performed major studies for OCLC and California State University and College System.

4.5 *Computer-Based Library and Information Services*

Considerable efforts have been made by few firms for the development of computer software oriented to library systems. Among the most established firms of United States in this area are: CL Systems (Newtonville); International Business Machines (IBM); Systems Control, Inc. (Palo Alto); 3M Company (St.Paul); Data Phase Systems (Kansas City).

CL System, Inc. (CLSI), a firm devoted entirely to library automation, started first with mini-computer based acquisition system and subsequently shifted to other areas of library operations. Its circulation system is quite popular in the United States and more than 200 libraries have already installed it. The system runs on a Digital Equipment Corporation PDB II Mini-Computer and uses bar-coded labels for identification of books and users. This system is further enhanced in its utility by two firms, namely Innovative Interfaces Ltd. and TPS Electronics, which have developed microcomputer packages allowing the transmission of data from OCLC terminals to CLSI system. IBM has also developed a library package operating with a system known as "Library Access System" being actively marketed in USA, West Germany, Canada under the name DOBIS. This system is used mainly for data collection, storage of files, and data transmission. System Control, Inc. is another aspirant in this field which have developed a mini-computer based software programmes for circulation system programmed in BASIC on PDB II. It also developed software for other functions of libraries. Compared to the above commercial firms, Data Phase Systems, Inc is comparatively a newcomer in the software industry and has successfully developed a circulation and a technical processing systems based on Data General Mini Computer and a operating system called MUMPS [15].

4.6 *Market Studies*

Market studies form an important area of activity of fee-based information services. A variety of custom-tailored marketing reports are prepared by these services. Some idea about the activities of these services can be had from the following examples:

a) A company is looking forward to develop a new product. Information brokers can help them by carrying out a marketing study which will include information on present market size, growth factors, competitive situation, leading brands, new product trends, advertising promotional opportunities and consumer usage, etc.

b) A company has a product and an established market. The Company is interested in acquiring a special or new market. Information brokers can help him by providing the appropriate information.

c) A company might be interested to know the projected market for mini computers in Europe over next five years. Here also the information brokers can help him providing the detailed assessment of the whole situation.

Custom-tailored market studies are the major source of income for the fee-based information services.Charges for such custom-tailored reports are quite high compared to other services and may go even up to $ 8000 for a-200-page report that may take one to two months of researching and writing. The names of some of the firms which specialize in the area are: Information Store; World Trade Business Information Centre, Golden State University; Washington

Researchers; Information Specialists (Cleveland); World Wide Information Service,Inc (New York) Mc Graw-Hill Publishing Co/Marketing Information Centre (New York); FIND/SVP (New York).

4.7 *Supporting Services to Libraries*

Quite a few firms are providing services to libraries for their routine operations such as circulation, cataloguing, indexing and abstracting, organization and maintenance, etc. In the field of cataloguing, 50 broker companies have chosen to subscribe to the MARC Distribution Service in order to provide catalogue cards, book catalogues and other products to the clients. Similarly Blackwell/North America (Portland) has taken over the marketing of automated bibliographic system developed by Richard Abel Company. The Company's data-base consists of MARC data, the University of California Catalogue Supplements, MARC records from other nations, company owned cataloguing staff and clients. Clients may order set of cards (for each documents) with or without documents. It is also possible to get photocomposed book catalogues or Computer- Output - Microfilm (COM) Catalogues. Although input from the customers has been either in hard copy or magnetic tape, the Blackwell is also in the process of establishing an on-line system, where requests can be received directly from the libraries by the company. Another company in the same line is the Inferonics, Inc. which have developed an on-line catalogue support system using MARC data. Other major broking firms in this line are: The Broadart Company (William Sport) and Baker & Taylor (New York). The Broadart provides custom services for catalogue conversion. COM Catalogue production drawing not only on MARC data but also several other large bibliographical data bases. This company has also introduced an on-line system for some acquisition tasks, dubbed as "Instant Response Order System" (IROS).

4.8 *Organizing Conferences/Seminars/Workshops*

This is an area which is recently emerging. Very few services specialize in this area. It seems to be a profitable venture to take up contracts for such conferences/seminars. Arrangements for organising one day programme for 100 persons normally cost at least $ 5000 to the clients in any major city of the United States. Besides taking contracts for organising seminars, conferences and workshops, some fee-based services also offer some professional seminars. For example, Washington Researcher, an important fee-based service offers six seminars annually (bimonthly) on various topics of interest to business personnel, researchers, information specialists, etc.

4.9 *Publications*

Publications are another profitable area of the fee-based information services. A majority of larger information services have also become publishers of literature of all kinds: primary (journal, books, reports), secondary (abstracting/indexing service), tertiary (directories, etc.). Publications are compiled by different methods. Some publications even are created by their in-house files generated in the course of quick-information questions, performing searches, or conducting market studies or they may obtain from other information services that lack the capacity to market their own publications.

The price range of these publications are very wide. The lowest price offered by an information service is produced by the Washington Researchers. The company's directories of various information sources, particularly the government ones, are priced as low as $ 5. Its most expensive directory is priced $95.

5. NATURE OF INDUSTRY IN INDIA

Information broker industry is still in its early stages of development in most of the countries. United States is the only exception where over 300 such fee-based services are operating. There are many similar services in other countries also. Some idea of this can be had from the list of information brokers and consultants in the Directory of Information Market Place, 1978-82 which contains details of more than 25 such brokering firms from Australia, Belgium, England, France, Germany, The Netherland, etc. The journal of fee-based information service regularly updates such a list from time to time.

While the Indian industry is at an embryonic stage of development, yet quite a small number of firms have taken steps to enter in this novel area. The activities of the Indian firms can be categorised as follows:

In the first category of firms in India are included those broking firms which are full time working, engaged in diverse library and information activities and are capable of searching and providing to clients documentary information in the form of books, journal reports, patents, conference and seminar papers, theses and dissertations, trade literature, standards on any subject and in any form from any part of the World. There are two firms of this kind known by the name of Constellate Consultants (P) Ltd., New Delhi and Informatics (India) Ltd., Bangalore. Both the firms were established just three to four years ago and within this short period of time, they have become profitable and are now on road to acquiring considerable business. As a result, their staff strength has also increased considerably. Constellate Consultants has at present a staff of about 40 people consisting of engineers, subject specialists and professionally trained library personnel. This firm is headed by a person who is an engineer by training and has a large experience of information handling in an industrial environment. He claims to have widely travelled and his firm has been one of the active users of the foreign brokering services. It has clients from all over India. Informatics (India) Ltd., Bangalore, has a comparatively small team of 18 people, comprising 5 professionally trained and the rest as supporting staff. A major portion of the activities of this firm is confined to South India. These firms have established themselves mostly at those places where a large number of users with high degree of information consciousness, a considerable amount of library and information facilities and professional activity, and a large industrial base exist. The broad range of services offered by these two vending firms are: document procurement and distribution, information searching (manual and computerised), consultancy, translation, information analysis and management, etc.

Document procurement and distribution is one of the major activities of these two firms. Requests are received by them for all sorts of documents namely reprints of serial articles, reports, monographs, standards, etc. Most of the requests are received from R&D institutions, industry, universities and government departments. In addition to this type of document procurement, Informatics (India) Ltd. also specializes in journal procurement and vending of books.

Its journal subscription service claims three big advantages, viz. saving paperwork, minimising risk and economy in spending. Among its various services, procurement services seems to be quite popular in Bangalore. As for report literature is concerned, Constellate Consultants, in particupar, specialises in procurement of NTIS reports. It is also managing dealer of NTIS reports in India. The National Technical Information Service (NTIS), an agency of the U.S. Department of Commerce, is a centre source for the public sale of U.S. and other foreign government sponsored research, development, and engineering reports and analyses prepared by various government agencies. The requests of NTIS reports are generated by Constellate Consultants (P) Ltd.by preparing a COPS, an acronym of constellate prepared search is a list (bibliography) of NTIS reports, in a specified subject, by its staff members by searching the NTIS data base. Such bibliographies are prepared both on request and in anticipation of user's demand. Informatics (India) Ltd. is also in fact the sub-agents of Constellate Consultants for the promotion of NTIS reports in South India. Besides, Constellate Consultants (P) Ltd. are also the only distributors of Engineering Index in India.

Information searching is yet another important area of activity of these two firms. So far the major impact of this service has been only in the industrial sector; other users are slowly appreciating the potentiality of these vendors for this service. Major part of the requests in this area is handled manually because of the heavy cost of searching information through computer. A very small number of requests are handled on computerised data bases available in the West. For computerised searching of data bases, both these firms had made some arrangements with international brokers. Constellate Consultants had made arrangements with another broker firm "SIL Information", Ottawa in Canada, which does all the on-line searching jobs for them. On the other side, Informatics (India) Ltd. is a member of Dialogue System in USA, a vending firm. The firm normally mails the request to Dialogue System and gets a complete literature on any subject and on any particular data-base within 4 to 5 weeks. This firm is also successful in sending their requests through telex, which saves another two weeks of time.On an average, Informatics (India) claims to making 20–25 computerised searches per year. The average charge per search normally comes to Rs. 1500/–. Constellate Consultants also claims of using regularly data bases for its clients.

The third important service provided by these firms is in the area of patents. In this area service includes searching, supply, technology transfer and registration of patents. Patent search service retrieves patent information on any subject from any part of the world and in any language. Patent supply service ensures exact location and supply of both Indian and foreign patents. In addition, these vendors claim to assist in technology negotiations with the inventors and also legal support to them which ensures help in registration in India and other parts of the world. In this area, major customers happen to be again Industry and R&D institutions. This is an area where the traditional library and information services are not very strong. So the chances for bagging business in this area are exceedingly bright in future.

In the area of other services namely, information consultancy, information analysis and management and marketing, not much headway has been made by these two firms. Although the Constellate Consultants (P) Ltd. have a group of about 10 people in the computerised information department, most of them are devoted themselves to development of softwares related to the systems development of fixed deposits share accounting, etc. Not any significant work has been done towards development of software for library operations. Constellate Consultants (P) Ltd. claim that they are in the process of developing software based on mini-based computer systems for library routines like purchase ordering, library stock taking and journal management. On the other hand, Informatics (India) has identified this area as one of their important future activities. India's large number of libraries and information centres are planning to use computer as an important tool. There is likely to be lot of activity in this area in future. However, at present both the firms seem to be getting a small number of contracts in this area of consultancy and that too from industrial sector only. Informatics (India) at present is able to secure one or two consultancy contracts per year mainly for design of library systems.

b) The second category of firms refers to those which are mainly concerned with commercial information & processing of data [16]. The names of firms working in this are are Commerce Research Bureau (Bombay), Centre for Monitoring Indian Economy, (Bombay), Operational Research Group (Baroda) and Tata Economic Consultancy Service. Recently Mafatlal Group of Industries has also started a service of this kind, located at Bombay. Of these, the first two are the prominant sources of general industrial economic information. These organisations basically collect the statistics made available by the government (both basic and secondary) sources, other published sources of industry, etc. The information is then transformed into or classified into distinct categories and published regularly. They supply information both in processed and semiprocessed form. They also carry out analysis and even furnish simple estimates of some select indicators. The annual charges of the entire package of published service is around Rs.15,000. Specific enquiries from the members are also entertained. The total membership of these two information agencies, however, stands around 200–2500, with considerable overlaping [8]. Amongst those services the major firm which is involved in the analysis and forecasting of commercial data is Operational Research Group (Baroda). As far as Tata and Mafatlal Group of industries are concerned, they have come up initially to meet their own internal needs. They have slowly been extended for commercial purpose.

c) The third category of firms are mainly involved in the development of software and use of existing software packages in various library operations. Among the various computer firms orienting themselves in this area, are Hindustan Computer Ltd., Tata Consultancy

Ltd., Computronics India, Centre for Development of Instructional Technology (CENDIT), etc. Most of these firms are in the process of development of software based on mini-computer and large-frame computers. In this area, most of the work has mainly been at the experimental stage. It is expected that more computer firms are likely to participate in this type of work in future and provide variety of services as soon as some initial success is achieved in this type of work.

d) The fourth category of firms are involved in providing industrial information. These consulting firms meet variety of information needs of industries, which ranges from collection of information on a product or process to the preparation of trend reports and feasibility reports, Some of the consultants even specialise in procurement of literature like reports, patents, standards, etc.

e) The last category of firms are mainly involved in the collection, processing and dissemination in highly specialised technical area. Some of the firms in this area are Zinc and Lead Information Centre, Delhi; Copper Information Centre, Calcutta; Indian Chemical Industries (ICI) Information Centre, Calcutta; Indian Aluminium Research Institute, Bangalore. Most of these centres operate on a membership basis and the information needs of their clients are met just by paying the required membership fees.

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COMMUNICATIONS IN JOURNAL OF THE GEOLOGICAL SOCIETY OF INDIA 1980 : AN ANALYSIS

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Sample statistical data of the research output of Indian geologists indicating the trend in their publication activities has been presented. Time lag, citation pattern and geographical distribution of authors concerning the publications have been analysed. Information needs and habits of Indian geologists have been ascertained.

1. INTRODUCTION

The science of geology is making great progress because of its close relationship with our day-to-day problems. This science that enables us to find and exploit natural resources hidden in the earth, giving us new ideas about space and time, is at present being taught in more than forty universities and other institutes of higher learning. Besides these seats of higher learning, research in Geology is being carried out in various research organisations also. Lot of money is spent when geologists go for field work to collect samples and data and later when these samples and data are analysed in the laboratories. These being the investments one has to measure the output. The output, in terms of new knowledge, is the geologists' communications in the form of books, dissertations, theses, articles in periodicals etc. Of the various media of communicating research findings, the journals, undoubtedly, appear to be most useful and suitable.

2. PURPOSE

In the following pages an attempt has been made to analyse the patterns of research communications in one complete volume of a geological journal, namely, the "Journal of the Geological Society of India, Vol. 21, 1980". The purpose of the study is to find ways and means for ensuring proper research planning in terms of financing research projects and developing new courses and areas of research. Such an analysis may also help the concerned librarians in the choice of subscribing geological journals. To get an idea about information needs, habits and requirements of Indian geologists, such a study may also be useful.

3. JOURNAL OF THE GEOLOGICAL SOCIETY OF INDIA

Journal of the Geological Society of India was described by some senior geologists, whom I consulted for the purpose, as one of the most representative media for communicating research findings of Indian geologists.

The Geological Society of India, devoted to the study and research in all branches of Indian geology, was founded in Bangalore, and registered on 28th May, 1958 and finally inaugurated on 23rd January, 1959. From the same year the Society started publishing the journal. The journal was annual from 1959 to 67; half yearly from 1968 to 69; quarterly from 1970 to 1976; and monthly from 1977 onwards.

4 PROCEDURE

All the twelve issues of the 1980 volume (v.21) of the journal were scanned. The data thus gathered have been presented in various tables to illustrate various points discussed in the paper.

5 RESULTS

The 21st volume of the journal under reference carries a total of 94 communications. Out of these 94 communications, 54 (57.44%) are full length research papers; 36 (38.30%) are short research notes; and 4 (4.26%) are other communications in the form of comments etc. as shown in Table 1.

Table 1 - Nature of Communications

Issue No.	Full length research papers	Research Notes	Comments	Total
1	7	1	-	8
2	5	2	-	7
3	3	7	-	10
4	6	4	-	10
5	3	3	-	6
6	3	4	1	8
7	4	3	-	7
8	5	1	1	7
9	5	5	-	10
10	6	-	1	7
11	2	5	1	8
12	5	1	-	6
Total:	54	36	4	94

5.1 *Geographical Distribution*

Out of the total 202 contributors for the present volume, 182 (90%) are Indian and only 20 (10%) are foreign. Out of these 20 foreign authors 9 are from USSR; 4 from U.K.; 2 from Sri Lanka; 1 from New Zealand and 2 from Canada. Although the percentage of foreign authors was low, one interesting observation was that the first papers in most of the issues were by foreign authors. The details are shown in Table 2.

Table 2 - Geographical distribution of contributors

Issue No.	Total Contri-butions	Indian Contri-butors	Foreign Contri-butors	Remarks
1	17	14	3	First paper by foreign author
2	14	13	1	-do-
3	24	22	2	First 2 authors of the first paper foreigners.
4	22	21	1	First paper by foreign author
5	12	12	-	---
6	14	11	3	First paper by foreign author
7	13	12	1	-do-
8	18	15	3	First author of first paper foreigner
9	23	18	5	Second author in first paper foreigner
10	14	13	1	-do-
11	16	16	-	-
12	15	15	-	-
Total:	202	182	20	

5.2 *Time - Lag*

The date of receipt is not mentioned in 17 communications. For the rest the average time taken for publication works out to 1 year and 3 months, with the minimum and maximum time taken being 2 months and 2 years and 5 months respectively. 17 communications were published in less than a years time, 55 communications took 1 to 2 years of time for publication and 5 publications took more than 2 years for publication. 50 publications (53%) were accepted for publication without revision, whereas for another 44 communications the authors were asked to revise their commmunications. We do not find any date of receipt or date of acceptance in case of the communication of foreign authors. Neither we find that any paper by foreign author was returned for revision.

5.3 *Authorship Pattern*

The analysis reveals that team research is the demand of the day. Out of the 94 communications only 29 are single-authored, whereas the remaining 65 communication have more than one author. In some communications the number of authors is as high as seven. The analysis is shown in Table 3.

Table 3 - Authorship pattern

No. of authors communicating a paper	No. of Communications	Percentage
1	29	30.85
2	36	38.29
3	20	21.27
4	6	6.38
5	1	1.07
6	1	1.07
7	1	1.07

5.4 *Citation Pattern*

Out of the total of 1128 citations in all the 94 communications, 831 (73, 68%) are journal citations and 297 (26.32) are citation to books, Ph.D. theses, some unpublished works, etc.

64% (721) citations are by foreign authors; 36% (407) are by Indian authors and 13% (144)

are self citations. The citation count of all these journal citations, communication wise is : 442 (53%) journals were cited once; 93 twice; 31 thrice; 11 four times; 4 five times; 1 six times; 2 seven times; 1 eight times; and 2 nine times.

5.5 *Institution-wise Break up of Communications*

Out of the total of 94 communications a significant proportion of 48 communications (52%) has come from research institutions, 31 (32.97%) communications have come from universities and 7 (7.74%) from colleges. Regarding the other 8 (8.53%) communications the source could not be ascertained as their respective authors had mentioned their private residential addresses in their communications.

Table 4 - Institution-wise break-up of Communications

Institution	No. of Communication	Percentage
Research Institutions	48	51.66
Universities	31	32.97
Others	8	8.53
Colleges	7	7.44

5.6 *Frequency of Journal Citations*

For this purpose 13 most frequently cited journals were taken into consideration. The journal under reference, itself, was cited 73 times in a total of 831 journal citations in all the 94 communications, followed by Tectonophysics, cited 16 times. Journal of Sedimentary Petrology and Journal of Geology have each been cited 15 times; Earth and Plantary Science Letters cited 14 times and so on. Journals like *Science, Current Science, Nature,* etc. have also been very frequently cited. However such a frequency rate will vary from volume to volume.

6 DISCUSSION

The originality and the authenticity of the research communications is well accepted as in the present volume, we find that only a meagre percentage (4.26%) of the total research communication required discussions etc.

Although the percentage of foreign contributors was quite low (10%), the first paper in most of the issues of the journal were by foreign authors. From this one may infer that, either i) the quality of the research work of foreign authors giving latest techniques, methods and ways etc. are of considerable interest to the research work of Indian authors or ii) it is just a craze to publish the papers of foreign authors as first papers, to give the journal an international character and have an international acceptance. Publishing the papers of foreign authors without giving their dates of receipt, dates of acceptance and without asking any of the foreign authors to revise the paper, are some other observations under the study that support the above mentioned inferences.

On the basis of analysing citation pattern we can infer that journals are the main media of communicating research findings. Indian Geologists depend much on the research findings of foreign authors to communicate their own. Frequent and regular citation of the various journals shows that these are indispensable for any geological library. If two or three more volumes of the source journal are studied and analysed on the same lines, a librarian can very easily make a fair selection of important geological journals for his library. The function of colleges and universities being primarily teaching, a large proportion of research output comes from research organisations/institutions. It is here that new areas of research can be introduced, new courses to be taught in universities and colleges, can be developed. Hence, proper funding of these research centres can help the geological research set-up ensure a sound footing. For a significant proportion of the communications we could not ascertain the institutional break-up as the contributors had mentioned their residential addresses in their communications. From this we may infer that in such cases the communicators might not have been financed for carrying out the research work, or the communicators might have to undergo various formalities for seeking permission to publish the communications, thereby unnecessarily delaying their publications resulting in out-dating of the information communicated.

7. CONCLUSION

Speed in communicating research findings in geology can best be ensured by improving the standard of already existing journals in geology, rather than increasing the number. Criteria of a journal to be standard are its regularity, periodicity, scope, coverage and acceptance (circulation). It is better to do away with the journals that are least or never cited and try to go in for standard publications. Speed in communicating the research findings can also be ensured by cutting short various formalities, the communicators have to undergo for communicating their findings.

8. ACKNOWLEDGEMENT

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A MATHEMATICAL EXTENSION OF THE IDEA OF BIBLIOGRAPHIC COUPLING AND ITS APPLICATIONS

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The idea behind bibliographic coupling was put forward independently by Fano and by Kessler. The credibility and applicability of the idea have however been questioned. In the present paper the idea has been extended and mathematically formalised. A measure of the strength of coupling vis-a-vis clustering has been proposed. Use of coupling for assessing cognitive scatter and progression of cognitive linkage has also been discussed. The limitations as well as usefulness of the principle have been critically analysed.

INTRODUCTION

During the last two decades citation indexing has become popular as a device for retrieval and searching scientific publications on a topic or a field of research. Citation indexes are providing information scientists with useful materials for studying literature patterns, information generation and propagation etc. All such activities are based on the hypothesis, taken as a major premise, that between a citing item and the members of the cited set of items, there is a cognitive relationship linkage of some form. In other words and in weaker terms it may be said that the citing item makes use of some piece of information contained in each of the cited items for some purpose relevant to the context and content of it.

As a consequence of this it has been suggested that citations can be considered as index of cognitive linkage between documents, just by the nature of use by the authors instead of actually assessing the content and subject expression of them. Therefore Fano[1] and Kessler[2] independently suggested that if two different documents refer to a common item, they should have a sort of closeness in their approach, study, context or cognition. Those which have no common cited ancestors are more likely to be unrelated or conceptualty afar[3]. If the number of common citations for two different papers be multiple rather than single, their strength of coupling is said to be more, implying that their cognitive contents are much close to each other. Kessler in a series of papers has further tried to establish the usefulness of the idea[4]. The notion of bibliographic coupling and these works have attracted the attention of experts in bibliometrics and information analysis as interesting but have hardly been taken seriously. The main criticism is against the hypothesis that a common parental citation may be considered as ensuring cognitive relation[5]. Even multiple common citations may not guarantee the breed of brotherhood in terms of content. At best one can say that more the common citations, more is the probability of their being cousins. We therefore felt that the idea of bibliographic coupling should be theoretically elaborated and a general mathematical framework be supplied.

MATHEMATICAL FRAMEWORK

Instead of considering one step citation, we propose to formulate in terms of generations of citations. Further, instead of considering the common citation or citations of two papers we think in terms of citation populations taken together. In this way we can then prepare correlation matrices and quantitative measures of the bibliographic coupling strength and propose direct applicability to clustering of items. Let $D_{1j} = d_{ij}$, j=1.n be the set of papers at a certain period of time t_1 considered in the context of the study. Each of dij cites a set of papers which we call as the parent set or the first generation ancestor-set of citations.

Let this generator set be denoted by

$$D_{oj} = \{d_{oi}\}\ i = 1, m.$$

Now, the totality of the papers of all these first generation ancestor-sets, we call the first generation acestors or the cited pack, G_p.

Therefore
$$G_p = \bigcup_{j=1}^{n} D_{oj} = \{g_{oi}\}_{i=1,N}.$$

Now, each of g_{oi} generates citing pack: which includes d_{ij}'s i.e. $D_1 \subseteq C(G_p)$ where $C(G_p)$ denotes the Citor-generated by the members of G_p. This relationship may be represented by the form of a matrix of the following sort:

← CITED PACK →

CITING PACK ↓	g_{01}	g_{02}	g_{03}	g_{04}	…	… g_{0N}
d_{11}	1	0	1	1	…	… 1
d_{12}	0	1	1	1	…	… 0
d_{13}	1	1	1	0	…	… 1
d_{14}	0	0	1	0		0
⋮	⋮	⋮	⋮	⋮		
⋮	⋮	⋮	⋮	⋮		
d_{m}	1	0	1	0	…	… 1

n x N Boolean matrix

Fig. 1. A hypothetical Boolean matrix. 1 denotes citation, 0 denotes absence of citation.

The Boolean matrix in Fig. 1 shows the citation links in general of the two populations and therefore the nature of coupling for the whole set of papers in question. This may be used for generalising the notion of coupling into bibliographic cliques and clusters.

Clusters would be formed by the populations which have at least one member having coupling with another member whereas, no member of one cluser will have coupling with any member of another separate cluster (Fig.2).

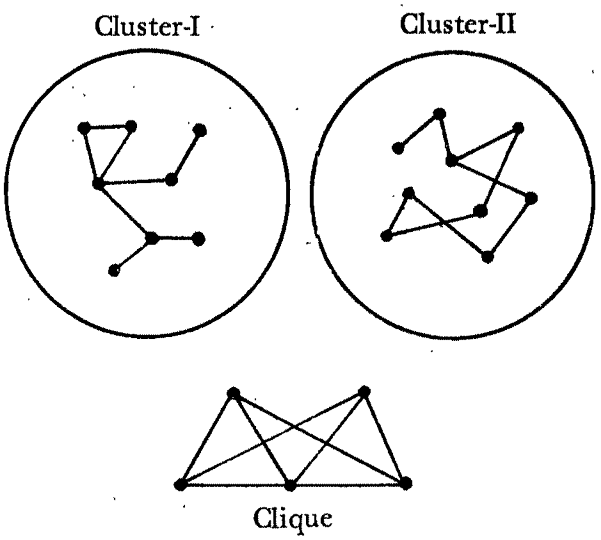

Fig. 2. Clusters are formed when an article (a member of the cluster) has coupling link with atleast another member. No member of one cluster would have link with a member of another separate cluster. Cliques are formed when every member has linkage with every other member. Nodes denote articles and lines-linkages.

Now, let us attempt at defining some measures of strength of single link (one generation or first step) citations coupling.

1. D_{ok} denotes the set of documents cited by d_{ik} and D_{oj} by d_{oj}

Therefore, the set of common citations = $D_{oj} \cap D_{ok}$ and total cited set of both = $D_{oj} \cup D_{ok}$

We define the duplet coupling co-efficient (C.C) for the two papers d_{ij} and d_{ik} as

$$C.C. = \left| \frac{D_{oj} \cap D_{ok}}{D_{oj} \cup D_{ok}} \right| \text{ where } 0 \leq C.C. \leq 1, \cdots \quad (1)$$

Generally, we may write for n papers —

$$C.C.(\text{multiplet}) = \left| \frac{\bigcap_{j=1}^{n} D_{oj}}{\bigcup_{j=1}^{n} D_{oj}} \right|, \cdots \quad (2)$$

2. Considering the matrix, taking each row against a document or paper as a vector of Boolean elements we may define another

measure calling it Coupling Angle (C.A.).

$$C.A. = \frac{(D_{oj} \cdot D_{ok})}{\sqrt{(D_{oj} \cdot D_{oj})(D_{ok} \cdot D_{ok})}} \quad \ldots (3)$$

We understand that both of C.C. and C.A. give coupling strength and relative inclination of the papers but the cognitive association cannot be ensured unless a valid cut-off factor or threshhold point is determined. For determining this threshhold there is no theoretical basis at present. The best course is probably to project a value phenomenologically by actual experimentation. But, such an experimentation would involve assessing the information content and subject expressions which would bring in imprecision and vagueness. Hence, such a phenomenological cut-off factor has to be semi-arbitrary. Heuristically we may attempt to arrive at some value. As we know $\cos \frac{\pi}{3} = 1/2$, so for C.A. threshold may be taken at 0.5 which should give high correlation or strong coupling.

Vertical generalisation

In the previous sections we have attempted at a horizontal generalisation of the idea of bibliographic coupling taking only single time of citations. If we can consider instead of the first generation citation links, a number of generations, the possibilities of generating most cognitively coupled clusters would be enhanced.

Let us consider the set of papers (T_n) which we take as n-th generation papers and among which we intend to establish coupled clustering. The cited set of T_n be D_{n-1}; similarly, the cited set of D_{n-1} papers be D_{n-2} and so on to the set D_o. At each generation level we would then be in a position to find the coupling strength. By taking a particular cut-off factor of multiplet C.C. (or a generalised C.A.) we should then get a particular chain of papers having relationships of being cited and citing. Therefore we may find a coupled cluster of papers among D_o having common citation ancestors at each upward generation. Taking different values of the cut-off factor we are able to generate radial clusters of diminishing coupling strength out of D_o. In this way we shall be able to ensure formation of clusters having various degrees of closeness of cognitive relationships. Because, with a single stage coupling cluster, the natural pitfalls frustrating the fundamental hypothesis adopted in the introduction can be avoided. These drawbacks and their elimination through the vertical generalisation procedure will be discussed later.

IMPORTANCE OF COUPLING

We must show where and why the horizontal and vertical coupling procedures, as set forth above, can be meaningfully and mechanically exploited. Information processing is a complex yet urgent requirement. Almost all facets of it either depend upon analysing the content thoroughly or on very simple enumerations of the type of document, the number of pages, the title, the number of items and such other highly artificial and elementary features. The difficulty with the first approach is that it involves penetration into semantics and syntactics of expression and language, and prior knowledge of at least the basics of the subjects with which the documents deal. Such processings are time consuming, and prone to vagueness and misrepresentation. This approach is liable to be highly qualitative and very difficult to automate. For the sake of feasibility recourse to arbitrary classifications, key word representations, terms frequency counts etc. have been superimposed but quantification of the devices employed are too elementary, too simple, incomplete and arbitrary to achieve meaningful result. So far, none has been able to show any functional relationship between the cognitive implication of the first approach and the arbitrary attributes of the second approach. Citation measures as a tool fall in the second category but stand as a third alternative between the two approaches. Citation claims a number of features of the second approach, whereas vindicating requirements of the first approach. But unprocessed simplistic citation approach without preconditioning and preprocessing is usually unworthy and too weak to meet the demands of information processing. The simple bibliographic coupling device proposed so far has all these inherent weaknesses of the simplistic citation approach [6,7]. The areas where the notion of generalised coupling as formalised in this paper may be exploited are listed below -

1. Establishing cognitive chain of information growth and dispersion;
2. Mechanisation of Information Retrieval without recourse to actual analysis of the content;
3. Clustering and classification of items of information according to their relative cognitive distances and/or linkages; and
4. Preparation of prospective and retrospective bibliographies of different spectral radii of topics with intended width.

As we have mentioned in the introduction, it is usually assumed that citing an item in the bibliographic reference implies that the author has used at least one piece of information from the cited items which is relevant to his work. So, citation emphasizes an information-based cognitive relation. As we have shown, this in itself does not warrant actual closeness of the two documents. Only with repeated citations and with formation of respective citations among a group of items we can be more or less sure of saying that the more linked items of this group have inherent conceptual and contextual affinities and our search for automatic mechanisable features for controlling and representing information processes can be rewarded. The formalised and generalised coupling technique as presented here has these qualities.

CRITICISM AND DISCUSSIONS

Time as a parameter plays a very important role in citation. Except on rare occasions, a cited item preceeds the citing item in date of publication. Almost all exceptional cases are difficult for identfying the cited item and without further corroboration of the date element and therefore are useless for our purpose. We should therefore neglect this small peripheral set although this act in itself may create some marginal effects. While referring an item of publication at a certain point of time an author is in principle in possession of all the preceeding items of information published over a long period of time. Usually, the sheer speciality of the topic and the space available in the publication medium restrict the number of items which can be actually cited. In all practical cases the time available to the author, circumstances or chances of knowing and getting hold of a particular past item randomize the selection of the set of bibliographic references. So, the items in this set have publication dates statistically scattered over a period of time through usually with a modal concentration over a span of time and publication media.

A document is specified by its date of publication along with other attributes eg. title, authorship, type of publication, pagination etc. For citation purposes the date is the chief parameter. But, for a number of items we cannot consider a specific date. So we have to account for the time parameter in periods or intervals. We can take such intervals of time in units of year, quarter or month. If we suppose that a particular item is published during the period. T_n, then its cited items can span through all of the previous intervals T_{n-1} to T_o, taking T_o as the date of publication of the earliest item among the cited ones. Similarly, an item published at T_n can have citations in the ensuring periods from T_m to T_{m+1}, T_{m+2},.... So two different items published in the interval Tn can have cited items falling in different intervals. It may so happen that one item cites a particular item at Tn-p which in itself cites another item at say T1, whereas the other item at Tn directly cites the item at T1. In such a case both the items of Tn may have cognitive linkage with each other but would not be reflected by our coupling scheme. For better precision, the scheme has to be modified to accommodate such a situation.

Another important interfering feature of temporality is that, unless we are restricting the choice of ancestors (1st generation) within limited interval, the enumeration of coupling strengths and of generating clusters would become cumbersome for the system.

Referring to the Boolean matrix for citing and cited packs d's & g's we should consider di's having publication dates at a certain intervals as well as all the g_i s also having publication dates at a particular interval.

Now, while going backwards in time for further ancestors we must not only take the citation links from the g_i's but also directly from the d_i's and for this accommodation we must modify our formulae. Such modifications later on. The scheme not only provides us with the generalisation of coupling data and their utilisation more effectively but also the scope for generalising and providing co-citation links. Indeed we are now in a position to generate profiles of culsters bound together through both coupling and co-citation. For co-citation data we need to take the column vectors instead of row vectors in our matrix diagram. One coefficient for co-citation would then be given by

$$\frac{G_i \cap G_j}{G_i \cup G_j}, \ldots \qquad (4)$$

where G_k represents the items among d_{1j}'s citing g_{ok}

We can derive from the matrix the set of most strongly related family of 'ancestors—progeny' papers determined by the relationship

$$G_i \cap G_j \longleftrightarrow D_k \cap D_l \cdots \qquad (5)$$

We shall call such a coupled offspring and co-cited parent papers as a bibliographic family.

CONCLUSION

The scheme of generalisation provided here need to be further refined. Some manual experimentation and development of suitable computer programme are being taken up by us. Such a practical operation requires carrying out the process backward and forward a number of times starting with a single paper or a group of papers published in a journal of specialised subject or from a book or a classified abstracting service.

Indeed some works of generalisations of the concept of bibliographic coupling[8,9] have come to our notice but we have not been able to identify any paper anticipating our ideas of direct generalisation both horizontally and vertically of the notion of bibliographic coupling.

An intensive research on clustering has been done in the Institute of Scientific Information including considerations of bibliographic coupling. However, we have not been able to know the exact theoretical models being used by others or by ISI from published reports[10,11].

We would like to express our thanks to Mr S Arunachalam, Mr R Ojha and Dr D K Bandyopadhyay for their interests shown in this work.

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BOOK REVIEW

Library education across the boundaries of cultures; a festschrift to mark the Silver Jubilee Celebration of the Library Science Department, edited by Anis Khurshid, Karachi, University of Karachi - Library Science Department, 1981, xi, 190p. Rs.65 [$ 12.00] (Revised by B. Guha).

It is certainly a laudable idea to bring out a good publication on library education to mark the silver jubilee year of a library science school. Such a venture can be an indication of the awareness of the school of its responsibilities. In this context it is grafitying to note that the Library Science Department of Karachi University has been able to bring out this handsome volume of contributions on library education.

The publication has just ten contributions from eminent library educators and an informative introduction by the editor. Among the contributors, one would be delighted to see the name of Jesse H Shera, who writes in his inimitable style on 'Across the boundaries of culture'. From India, P N Kaula has written on 'Teaching pattern of library and information science in India'. While depicting the library education scene, the author has shown his usual apathy for the Information Science course conducted by INSDOC. He could not devote even one full sentence to this course in an account of twelve pages. There is one contribution from Prof Neelameghan along with Patricia B Carino on 'Some user-friendly features of COMPAIS II–A'. This system, as is known, has been designed and developed at the Institute of Library Science, University of Philippines. The user-friendly features in a computerised information system have been very ably presented in this paper.

On the Department of Library Science of the Karachi University, the sponsor and publisher of the present volume, a very informative paper has been contributed by Prof Abdul Moid who was associated with this school since its inception in 1956 and is presently with the Bayero University, Nigeria. Prof Mohammed M Aman of the University of Wisconsin, takes a look at the Muslim world in his contribution 'Library and information science education in the Muslim World'. He laments to say that 'libraries in many Muslim nations remain untouched by the advancements which the profession has witnessed in the last few decades of this century'. In the next contribution, Prof Oli Mohamed, from Malaysia, brings librarianship even closer to Islam. He attempts to investigate the status accorded to knowledge in Islam and its contribution to the development of libraries and librarianship. The author also makes a suggestion for the formation a Congress of Muslim Librarians and Information Scientists to meet the challenges of the information age.

Mrs Poori Soltani writes on the problems of library education in Iran. Very few can be more knowledgable than her on this topic. Syed Jalaluddin Haider of the Karachi school makes a comparison of library education in Iran and Pakistan, in the next contribution. He assures that while comparing special attention has been paid to only those problems which are shared by the majority of the Third World countries in this field.

The remaining two contributions are from Prof. Harold Goldstein, Florida State University, and Prof P Havard-Williams of the Loughborough University. Prof Goldstein writing on the American library education and library development, states, "…..if current American education has anything to contribute to its international relatives, it could well be the 'missionary spirit' of to-day's student/tomorrow's professional staff member who accepts a commitment to continuing professional development", Prof Havard-Williams writes on "Library and information studies: the creation of a department", bringing out in an interesting manner the birth and growth of one of the most important library school, the Department of Library and Information Studies of the Loughborough University.

The care that has been taken in the production of the volume is clearly in evidence in the detailed and useful index, covering about 24 pages, that has been appended. This is also a valuable contribution greatly enhancing the value of the publication.

The publication will be of interest to all library educators and an useful addition to all library schools collection.

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